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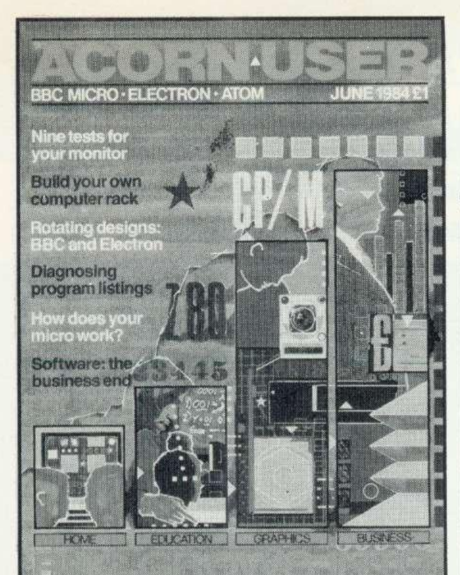
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BBC GROWS INTO BUSINESS



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Published by Redwood Publishing, 68 Long Acre, London WC2E 9JH. Tel: 01-836 2441. **Typesetting & Artwork** Vantage Group, Wardour St,. London W1. **Production** Aquarius Print and Design Ltd., Scala St., London W1. **Printed in Great Britain** by Watmoughs Ltd, Bradford. **Advertising Agents** Computer Marketplace Ltd, 20 Orange St, London WC2H 7ED. Tel: 01-930 1612. **Distributors to the News Trade** Comag, Tavistock Rd, West Drayton, Middlesex UB7 7QE. Tel: (0895) 44405. **Subscriptions** Subs Dept, Redwood Publishing, 68 Long Acre, London WC2E 9JH.
Tel: 01-836 2441.

Annual subscription rates:

UK	£15
Europe	£18
Middle East	£20
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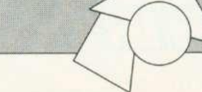
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Acorn User June 1984 Issue No 23

Features

Reviews

YELLOW PAGES EXTRA

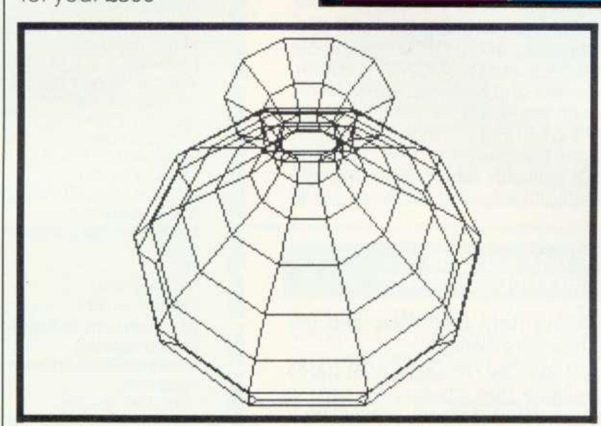


Regulars

IN THIS ISSUE . . .



Z80 bundle
Acorn's Z80 Second Processor could put the CP/M world at your feet. We report on what you get for your £300



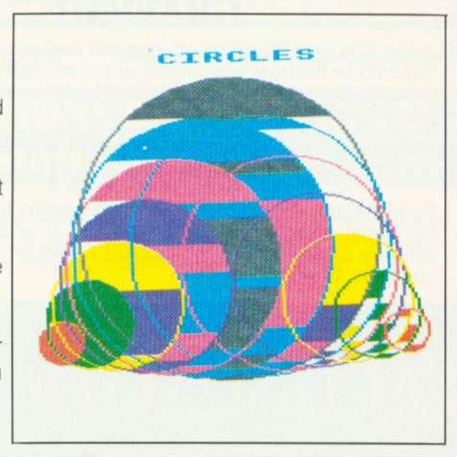
Soft Pottery
Jugs and vases galore created by rotating lines, and then coloured in to make weird and wonderful shapes. Malcolm Banthorpe is the master potter



Printers
Can a dot matrix hope to give letter-quality print? George Hill compares the NLQ Canon with a Sanple daisywheel pictured right

NEXT MONTH . . .

Communications:
Portable micros, bulletin boards and electronic mail
Colour printing:
State of the art colour from Canon's inkjet printer – as shown here
IEEE reviewed:
Three competing interfaces for the more serious Beeb user
First byte:
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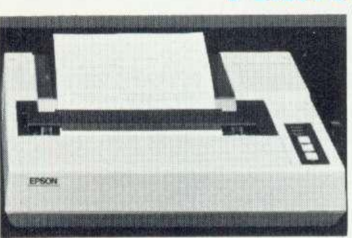


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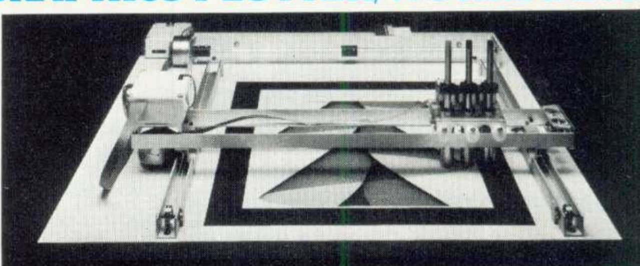
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is a full specification, direct connect modem, with both Originate & Answer les, allowing access to the many databases, bulletin boards, as well as r-computer communication. The modem conforms to the international TT V21 300/300 Baud standard. (NOTE: Not suitable for PRESTEL). Having BT Approval, it connects directly to the telephone line, for optimum ormance. Being battery powered, it is totally portable (optional power ply available). **£69.** BBC Lead **£3.50.** External PSU **£8.00**

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Continued on page 6.

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Healthy link for Acorn

BRITISH Telecom is preparing to launch a major networking system for the health industry – based around the Acorn Electron.

The Electron is at the heart of a terminal box, called Merlin M2105, that will be provided in the system known as Healthnet. This will link GPs, hospitals, district nurses and health centres to a central computer over the standard phone lines.

Circulars from drug companies, the Department of Health and hospitals could then be sent through the central computer to some or all of the Healthnet terminals.

BT refuses to give specific details of the system, because it will not be launched until the autumn. However, one of the terminals was due to be shown at Communications 84 in Birmingham.

The estimated cost for the terminal is about £1000, for which users will get an Electron (in BT livery), a specially-developed add-on box, printer, monitor and power supply.

The add-on box is impressive: 48k ROM, 64k RAM (32k with battery back-up so its contents are not lost when the machine is switched off), RS423 and Centronics interfaces, and the 'Kenneth Kendall' voice generator.

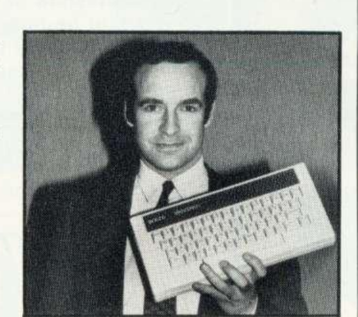
The voice chips are there to provide an answering service if any calls are received that are not from a computer.

One of the major tasks for the Merlin will be to relieve doctors and other health professionals of some of their paperwork. They will be able to design and store their own forms and documentation, or download standard versions from the central computer.

Networking to other terminals on a site, such as a hospital, will be possible through the standard telephone switchboard within the building. Users will be able to send messages by just typing in a phone number on the system. The battery memory will store a record of messages sent on Healthnet.

The hardware side of the project was developed at Acorn with some of the system software, while BT wrote the modem and other software. Field trials are underway within Telecom and at one of the London hospitals.

BT is unwilling to say whether the system will be marketed for other users, but one person close to the project commented: 'Medicine is the first crack, they are interested in other areas'.



Curry – and what the doctor ordered

Acorn will not be able to market the add-on box itself because it was developed under contract for BT. However, the company is obviously proud of what the system can do. A spokesman at Acorn explained: 'You think of an idea and Chain can be used for it'. (Chain was the name given to the system during development.)

Acorn undoubtedly has other ideas for the Electon under way, but the only comment was one often heard nowadays in the security-conscious company: 'We can't talk about those yet'.

Acorn acquires Torch

ACORN has reached an initial agreement to take over Torch Computers. The deal was signed early this month by Chris Curry, Acorn's managing director, and Bob Gilkes of Torch.

Talks started last August and came out of discussions with Chris Curry over the suitability of Torch's Unix for the US market.

Acorn director Alex Reid said he hoped Torch would market Acorn's ABM but that 'there has been no attempt to rationalise our product ranges so far'.

Both companies stressed that their ranges were compatible and neither expected to shelve products. A Torch spokeman said, 'Torch will become a subsidiary of Acorn plc – effectively the business arm.'

The takeover is expected to be complete by June.

Acorn's Icon

ACORN has bought into Torus Systems, which is launching a graphics-controlled local network called Icon, the first version of which is for the IBM Personal Computer.

Acorn MD Chris Curry sees the link as complementing his company's expertise in networking, and it will no doubt fuel speculation on the direction Econet is likely to take in the future.

Acorn User Olympia show twice as big

THE 1984 Acorn User Exhibition looks set to double the number of stands over last year.

The venue is Olympia 2, where the PCW Show will follow a month later. More than 30,000 people are expected to attend over the four days to walk around the 150 stands – two thirds of which have already been booked.

The big software houses such as Micropower, Superior and Computer Concepts are in, plus Acorn and Torch, as well as the smaller, more unusual companies such as the Miniature Tool Company, British Micro and Parfitt Electronics.

Olympia 2 is in Earls Court, West London, and the exhibition starts on August 16, running through to Sunday, August 19.

Details from Tim Collins, Computer Marketplace Exhibitions, 20 Orange St, London WC2H 7ED. Tel: 01-930 1612.

Beeb graduates to 16-bit

THE Graduate gives the BBC micro the ability to run software and hardware produced for the 16-bit IBM Personal Computer – and it costs under £700.

Data Technology, founded by Torch founder Martin Vlieland-Boddy, is the company behind the product, which will be launched at the Computerfair in June.

The Graduate provides 128k RAM, and is built around an 8088 processor that will run the MS-DOS operating system. Two versions, the G400 and the G800, will cost about £690 and £1000 respectively (the G800 has two 400k disc drives, the G400 one).

Bundled with the G800 is the latest Perfect software, which gives colour displays, and is estimated to be worth £1200.

The Graduate plugs straight into the 1MHz bus and no disc interface or sideways ROM is needed. A power supply is built in as well as two hardware expansion slots to take peripherals such as a mouse or 3270 emulation board.

'The discs are IBM format', says Vlieland-Boddy, 'so you can take an IBM disc and run it on our machine. It will run all the available software for the IBM PC and it's hardware compatible so it can use all the IBM peripherals being produced.

The BBC-Graduate combination offers a saving of something like £1500 over the PC, and would have the advantage of the Beeb's display facilities.

Allan Wright, former Torch technical director, has joined Vlieland-Boddy at Data Technology, which was set up last December.

Vlieland-Boddy was very specific on delivery dates: 'We are taking orders and should deliver 250 machines by July. It uses the 8088 chip set, where there has been a drought, but we've got 5000 sets'.

This is backed up by an order placed with BASF for 5000 disc drives to go into the Graduates – an order worth about £¾m, according to BASF.

Hobbit upgrade

IKON has launched an improved version of its Hobbit floppy tape drive. Called the Ultra-Drive, it costs £80 and gives 200k per cassette and is claimed to be ten times as fast as normal cassettes.

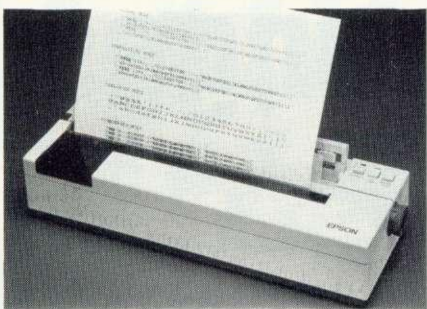
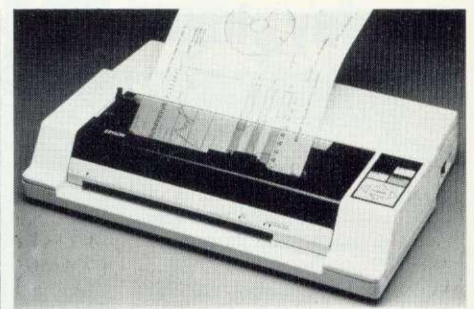
By command...

ACORN and Microvitec have both received Queen's awards for technical innovation.

Microvitec's accolate coincides with its entry onto the Unlisted Securities Market after 1983 profits of £2.5m on sales of £9.5m. The monitor manufacturer has also just presented the 20,000th monitor under the government's funding for schools schemes.

Telemod price

OEL has asked us to point out that its modem, Telemod 2, costs £84.95, and not £100 as stated last month.

New Epson runners: the £95 P-40 portable (left), the thermal transfer model P-80, the and HI-80, the company's first colour plotter

Six-pack send-off for Electron ROM box

PLUS 1, Acorn's add-on box for the Electron exclusively revealed in last month's *Acorn User*, will be launched at the end of May at £59, including VAT. And Acornsoft will be releasing six examples from its range in ROM format to coincide with the launch.

Three of the half-dozen will be arcade games: *Hopper*, *Snapper* and *Starship Command*. Then there will be the adventure *Countdown to Doom*, the computer language Lisp and finally the home education program *Tree of Knowledge*.

The ROM cartridges will cost about £20 each, which sounds expensive by cassette standards, but is about par for the course.

Others are planned, with another six 'coming soon'. The titles are still under wraps, but Acornsoft admits that a word processor and spreadsheet are on the way.

Meanwhile, Pace is driving hard to be first on the market with a complete disc filing system for the Electron. The system was demonstrated in London last month, but Pace has yet to announce a price and date for release.

The unit will be a totally enclosed 5¼in disc drive and interface which connects via a ribbon cable to the expansion bus at the rear of the micro.

The interface itself will use the 8271 disc controller chip, as used on the Beeb, plus a revised version of the Amcom disc filing system. Pace says this system will allow the Electron to load Beeb discs.

The Electron disc system will be available in both 40-track and 80-track formats and a special 'take-off' connector will allow other peripherals such as printer and joystick ports to be attached without interfering with the Pace system.

New quartet from Epson

TWO portable thermal printers are among four new printers to be launched by Epson this year.

These are the budget P-40, retailing at £95 + VAT and due out in August, and the P-80, Epson's first thermal transfer printer (£160 + VAT), available in October.

The P-40 is a compact dot-matrix model (46 x 216 x 128mm) which prints across 40 columns on friction-fed thermal paper. It prints at 45cps and 80 or 20 characters per line are selectable with condensed or enlarged character modes. It is driven by rechargeable batteries.

The P-80 – with 80-column capacity – runs at 45cps and prints in both text and graphics mode. It offers 63 international characters, a 96 ASCII character set and prints in both Pica and Elite in regular, condensed and enlarged modes.

Paper is friction-fed and sheets of 5½ x 8½in can be used. It can run with or without the thermal transfer ribbon. The P-80 also has rechargeable batteries.

In July Epson is launching a colour printer, the JX-80, which it believes to be the first to default to monochrome. Retailing at £560 + VAT, this is a 160cps dot-matrix printer that will produce up to seven colours. It has the same command set as the FX-80.

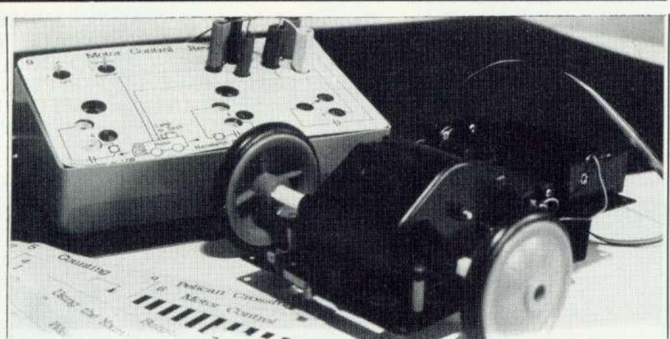
The fourth member of the quartet is Epson's first printer/plotter, the HI-80, which at £400 + VAT the company is promoting as the lowest-priced model in the UK.

Control lists free – from BBC

FANS of *Computers in Control*, broadcast in March and April, can now download (free) the software demonstrated in the BBC TV series – if their Beeb is fitted with a teletext adapter.

The software has been designed by the BBC Telesoftware Service to control external pieces of equipment through the micro's I/O connections, and enthusiasts will receive specifications for building their own equipment.

See page 700 of Ceefax for details.



NORTHERN Computers is hitching a buggy to its Micropulse Young Trainer, an educational robotics device launched in March that connects to the BBC and works under training software. The three-wheeled Micropulse buggy, costing £29 + VAT, comes with two light-dependant resistors that can be programmed so that it follows a torchlight beam or stops on contact with it.

Prestel rationalises micro databases

PRESTEL has made major changes to the way it handles Micronet 800 and the other micro databases. They will all now come under one umbrella called Prestel Microcomputing, and one standard subscription will be paid by users.

Under the new system, Micronet is treated in the same way as all the other information providers. It loses its exclusive start-up frame and the sole right to charge subscriptions. At the same time, databases such as Viewfax 258 which were formerly free now come under a subscription charge of £8 a quarter.

The launch was originally set for April 2 but was delayed until May 11.

Prestel Microcomputing will also be expanding, adding several new databases this year. These include Head Start for home users and Executive Micronet for business, both in June, to be run by Micronet.

School Link, put together by Prestel and *Educational Computing* magazine, will start in September.



Change of status . . .

ITV launches Sunday show

A WEEKLY series of five half-hour television programmes called *Me and My Micro* starts on ITV on June 10.

The Sunday morning shows, presented by actor, mathematician and *Playschool* star Fred Harris, is claimed by its makers, Yorkshire Television, to be the first TV series to acknowledge that programs are more fun than computers, software is more interesting than hardware.

Fred Harris will use familiar games to illustrate the fundamentals of Basic. The series aims to provide the building blocks with which the beginner can develop programs.

A different micro-user will make a guest appearance in each show – including a Midlands vicar who uses a Spectrum to teach confirmation candidates and a Yorkshire grandmother who generates knitting patterns on her micro.

A booklet based on the show is being published at £2.95, written by Paul Shreeve and published by the National Extension College.

Changes in View

ACORNSOFT has denied rumours that its View word processor chip has been withdrawn and refused to say officially whether an improved version is set for release.

Dealers have reported a dearth of the chips, while View 2.1 has been seen in ROM with several improvements over the first release (issue 1.4).

The fact that 2.1 is in ROM suggests it is about to be released, because software is expensive to produce in this way unless ordered in large numbers. Normally trial issues are put into EPROMs that are short-run chips and re-usable.

Acornsoft is quick to quash the rumours. A spokesman said: 'View has proved very popular and we intend to carry on selling it. Any rumours that we have withdrawn it are groundless.

'There has been a shortage because of demand, for which we apologise to customers, but we will solve this very quickly.'

On View 2.1 the company is very tight-lipped: 'We have a policy of continual development and may produce a new version in the future.'

The issue of View sold as standard on the American BBC micros is different from the British one, and this may have been used as a model for 2.1. Among the added facilities in the new chip is the ability to print directly from the screen without having to save a file first.

One possible reason for the short supply of View is the worldwide famine of chips, which also appears to be holding up the release of Viewsheet, Acornsoft's spreadsheet.

This is the next step in the development of a View 'family' of software, which will all link into the word processor.

Viewsheet provides several sophisticated facilities, among them the ability to put as many as 10 different windows from the same spreadsheet on screen at the same time.

Subsidiary disc files can be created so that the information they contain will be automatically updated when changes are made to the sheet that is being worked on.

Sheets can be spooled to disc and then read in to View for editing or for, say, inclusion in a company report. Also, sheets can be used in any screen mode, so mode 7 will give the ability to hold a very large sheet in memory.

Acornsoft will not give a release date for Viewsheet, apart from saying that it will be sold 'as soon as possible'. The next issue in the View family will be a much-needed printer-driver generator. What comes after that? 'I don't really want to talk about that,' said the Acornsoft spokesman.





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SOFTWARE CHART

		TITLE	PUBLISHER	TAPE	MICRO
1	(3)	Snooker	Visions	£8.95	B/E
2	(1)	747 Flight Simulator	Dr Soft	£8.95 (£11.95)	B
3	(6)	White Knight II	BBC Soft	£10.00	B
4	(8)	Snapper	Acornsoft	£9.95	B/E
5	(4)	Hobbit	Melbourne House	£14.95	B
6	(9)	Transistor's Revenge	Softspot	£7.95	B
7	(–)	Rocket Raid	Acornsoft	£9.95	B
8	(11)	Killer Gorilla	Program Power	£7.95	B/E
9	(–)	Gorf	Dr Soft	£8.95	B
10	(12)	Zalaga	Aardvark	£6.90	B
11	(2)	Twin Kingdom Valley	Bug-Byte	£9.50	B
12	(–)	The Mine	Program Power	£7.95	B
13	(–)	Fortress	Amcom	£8.95	B
14	(re)	Chuckie Egg	A&F Software	£7.90	B/E
15	(7)	Space Shuttle	Microdeal	£8 (£10)	B/E
16	(14)	Hunchback	Superior	£7.95 (£11.95)	B/E
17	(–)	Dare Devil Dennis	Visions	£8.95	B
18	(10)	737 Flight Simulator	Salamander	£9.95	B/E
19	(–)	Hopper	Acornsoft	£9.95	B/E
20	(–)	Mined Out	Quicksilva	£6.95	B

re = re-entry B = BBC E = Electron Prices in brackets are for disc version

BUBBLING UNDER

Amaze in Space	**Opus**	**Sphinx Adventure**	**Acornsoft**
Penguin	**H Soft**	**Disc Doctor**	**Computer Concepts**
Pedro	**Imagine**		

Compiled by RAM/Computer

HAVE the zappers been zapped? we asked, when only one arcade game figured in the top five last month. Not quite. They're fighting back, with *Rocket Raid* and *Gorf* leaping from nowhere to numbers 7 and 9 and other old arcade favourites – *Snapper, Killer Gorilla* and *Transistor's Revenge* – improving their positions.

Still, the more sedate stuff continues to dominate the medal positions. *Snooker* no doubt benefits from TV's constant championship coverage and *White Knight II* has proved that it's the best chess software available – Acornsoft's *Chess* has dropped out of the list.

Expect *Aviator* to arrive next month if the tenacity of the flight simulators (including Space Shuttle) is anything to go by.

We fanfared the arrival of the utility packs last month – and Psion's *Vu-File* and the £40 *Wordwise* chip were promptly ousted. We console ourselves with the £33.35 worth of ROM in the *Disc Doctor's* waiting room!

SOFT OPTIONS

SOFTWARE for the Electron has taken off with the release of **Salamander's** *737 Flight Simulator.* Written by a professional pilot, it includes a simulated engine failure! And **Micro Power** has now made most of its Beeb arcade titles available for the Elk, including old Beeb favourites such as *Killer Gorilla, Croaker* and *Escape from Moonbase Alpha.* The latest releases are *Danger UXB* and *Galactic Commander* and there's more on the way.

Constellation should make Electron users starry-eyed. It's just one of 11 titles released by **Superior Software** for this machine and the armchair astronomer can view a total of 455 stars from any point on the globe. Earthbound explorers can keep track of David Attenborough's latest expedition with *World Geography*, an educational program that covers 166 countries and makes use of the Electron's hi-resolution screen to test your knowledge of capitals and populations. Students of gambling can turn to *Fruit Machine,* whose features include spinning reels and HOLD, NUDGE and GAMBLE. Arcade action is provided by *Centibug, Alien Drop-out, Invaders* and *Percy Penguin.*

Something to write home about is the **Kansas** *Word Processor* for the Electron. Numerous facilities are offered, many of which can be implemented with a single keystroke. Text is formatted using embedded control codes and each text file can be up to 4,200 words long. If you can't type, try the Kansas *Microtype* typing tutor.

Educational software for the Electron is available from **Ampalsoft.** *Maths Level 1* and *Easy Reading* are aimed at the over-fours, while *Maths O Level Revision* Parts 1 and 2 help cramming students along the way with calculus, algebra and trigonometry. All titles are twin packs offering two cassettes containing four programs. Ampalsoft can be contacted on (0252) 876677.

Throw yourself in at the deep end with *Pool* from **Dynabyte Software,** or jockey for position with *Horserace,* a family game for up to six players. Other intriguing programs include *Corporate Climber* (can you make it to the executive washroom in time) and *Lemming Syndrome.*

Who said there was no software around for the Electron?

All games for BBC Micro 32K OS 1.2 only



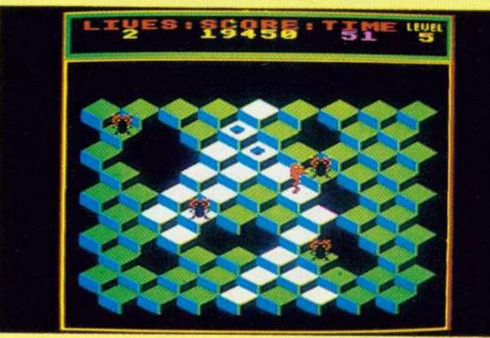


CASTLE ASSAULT



A glittering reward awaits the intrepid atop the heavily defended towering turrets of this forbidding fortress. On your quest for gold you will be assailed by a menacing menagerie of meanies, namely crabs, snakes, lobsters, spiders, bugs and beetles. Watch out for those malicious malades (the deadly Flying Ducks) as you dodge falling rocks, scale ladders and negotiate moving platforms. Collect various different fruits for bonus points on your way. Bonus man for every two bags of gold collected. Hi-score table, increasing difficulty and fantastic animation constitute this stunning game from MRM.

SCREWBALL



You are Screwball and you have 60 seconds to change the colour of all the squares that surround you (by simply jumping on them).
Menacing you all the time, however, are the 'BLACK BUGS' . . . and they sure are mean. They even cheat by sometimes not even walking on the squares.
If they catch you then I am afraid you lose a life. Kill the BUGS by digging holes for them to fall through. If you really are in a fix then as a last resort you may HYPERSPACE to the top of the grid . . . but you won't always survive the journey.

DARTS



Step up to the ocky and enjoy all the fun of competition darts with this high resolution version by MRM. A choice of 3 popular dart games, 501, Round the Board and Cricket is available in this package.

HANGMAN/SOLITAIRE



This great value two game package consists of a multi menu hi-resolution graphics version of Hangman (including a special category for children) with a colourful 3D version of Solitaire.



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ACORN ABUSER'S Diary

■ OUR high-level programming friend Beebalus claims to have invented a brilliant two-player game based on *JCB Digger* (known as *'Judder'*) and *Aviator*. His idea is to run *Aviator* in the second 6502 processor and JCB in the I/O (first) processor. One player controls the JCB from the keyboard while the other flies the Spitfire with joysticks. The JCB has to dig up the runway, demolish Acornsville and shake down the bridge before the aviator can take off, buzz Silicon Valley and come back to shoot up the JCB.

Beebalus expects to market the game through his company Deadwood Tax Avoidance (Jersey) Ltd.

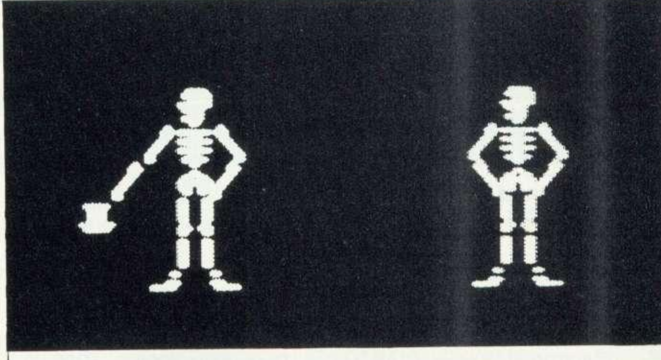
A spokesman for Deadwood said: 'The game will be available before the end of the year in which it is released'.

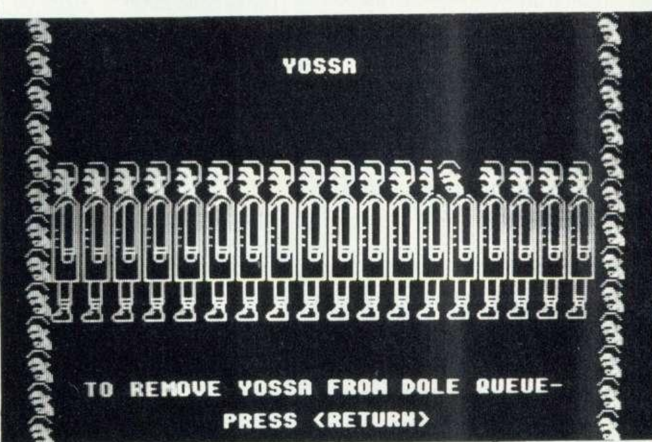
■ FOLLOWING the picture in a brochure of the QL manual written in Latin, the news from the SinQLair camp is that Psion is producing a Latin-English translator to help you understand it.

■ BANANA control is the latest task for the Beeb. Broadway Electronics has won an order to supply the Windward Islands in the Caribbean with computers for stock control.

We hope there's no ship-up in delivery.

■ ACORN'S new model C android has hit back at rumours that Acorn has dropped plans to introduce a new range of 'Tom Huff'n'puff' marketing managers. The android claimed that a set of managers had arrived from National Semiconductor in lieu of chip-sets and should start marketing 'later in the year.'





WHEN does black and white turn blue? When the BBC's mode 0 is used to produce naughty pictures. Modesty forbids us to disclose the source of these, er, animated scenes, but they're from a disc labelled 'Sicsoft' that found its way through our back door. The two pieces of software illustrated are excellent examples of cartoon animation featuring 'Gis a job I can do that' Yossa and a pair of performing skeletons. The rest of the disc would make Mary Whitehouse throw a wobbler.



Country cousin Curry

Chris Curry cultivates his Acorn acres

THE secret is out, hard-hitting Acorn MD Chris Curry, the man who set Sir Clive on the road to fame and fortune and then co-founded Acorn, has decided to return to the land.

Yes, the man whose contribution to British industry was so recently rewarded by the Queen and with a visit to No 10, has bought himself a farm.

We are sworn to secrecy as to its whereabouts, but the young millionaire will indulge his love of tractors and animals on its secluded acres.

We can, however, reveal exclusively that our Chris until recently kept a pet pig called Tig. But Tig became too big, so Chris had to give her up to a good home.

■ DEBBIE Harry walked into Microage and said: 'All I want is a ROM with a VIEW'. Not being very technically minded the salesman sold her a set of Microsoft Windows.

Picture that!

■ NEWS from *The Other User* is that Barry Wood applied for a job to Acorn's PR department in Altrincham. He was turned down. In retribution he is now extending his Barry Wood's Hairpiece column to a full page and printing the views of would-be Electron owners.

■ DESPITE contrary reports, the Gluon could soon be unforgotten. Incredibly, it can be glued-on not only to an Electron or an Atom but also to a SinQlair Plectrum, Commodore 64, Flan Enterprise (also known as Elan, Samurai, Fried Egg...); in fact it will turn any home computer into a Beeb. Sources claim that *any* program written for the Beeb will work perfectly on the Gluon!

Acorn will take orders for the Gluon 'very soon.' The price is expected to be just under £400 and you should quote the stock code ANB01 with your order.

■ Finally, dear readers, a little puzzle. What does the following Basic II and Electron program do?

```
10 DIM BLOCK 9
20 ?BLOCK = 31
30 BLOCK?9 = 13
40 A% = 10
50 X% = BLOCK
60 Y% = BLOCK DIV 256
70 CALL&FFF1
80 PRINT$(BLOCK+3)
```

Answers on a post-card to Mr A Wilson, Acorn Computers, Fulbourn Road, Cambridge. Over and out!

Jargon Jungle

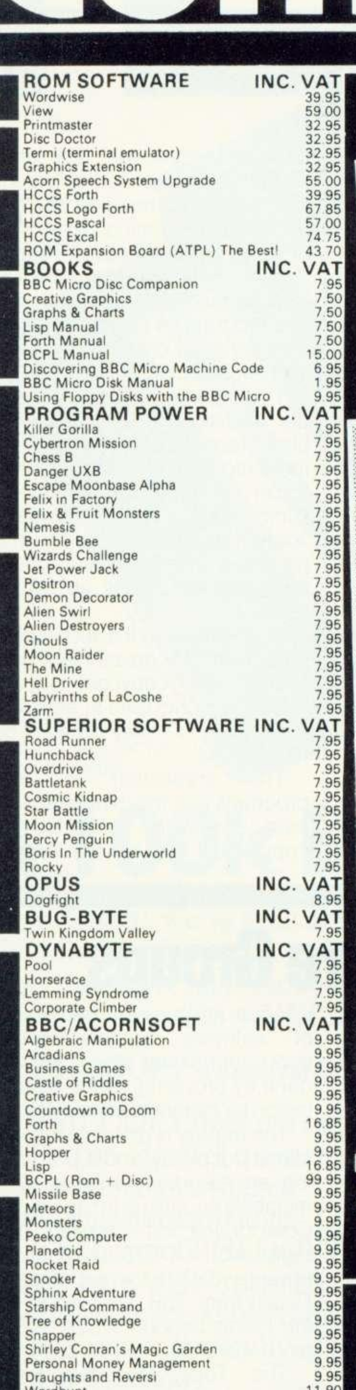
ONE of our senior computer monthlies has come in for a pasting from one of our readers. L Whalley describes the offending paragraph thus: 'Pretentious, self-consciously clever rubbish'. For those who missed it first time round, hack your way through this piece of Jargon Jungle from the February issue of *Personal Computer World:*

'*The Joy of Computers* is recognisably one of a new generation of computer related publications. Pac-Man and partworks have stalled, but the facts of real life – cars that are hand-built by robots and then talk back at the driver, trendy vicars getting flower rotas through the 6502 and the collected works of John Wesley onto Dysan – remain real enigma variations'.

Linnet Evans, who wrote the book review, may collect a small reward from our offices (readers may like to suggest a suitable one). L Whalley, our first Jargon Jungle winner, gets a crisp Wellington.

Computerama

the source



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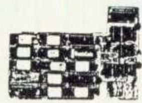
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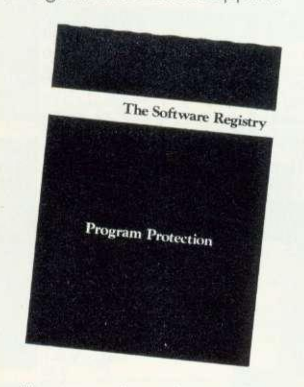
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Patchwork of protection for programs

As far as government legislation is concerned, software and computer programs don't yet exist. As various pressure groups tackle the government on copyright reforms, Simon Elsom examines the state of the law and the tenuous links by which copyright provides protection for software writers.

SOFTWARE firms have traditionally protected themselves by licensing their products, as opposed to selling them outright to customers. Before the recent boom in sales of micros, this, together with certain inherent features of software, usually provided effective protection.

Software was almost invariably written for specialist markets, so there was little incentive to copy. Furthermore, the software firm would soon spot any copies because each user (authorised and unauthorised) relied upon it for regular after-sales support.



However, the advent of cheap micros, has vastly increased the size of software markets – and the problem of protecting programs. Software houses increasingly use distributors and dealers, so it is comparatively easy for a dishonest dealer or user to copy and distribute illicit copies of popular software.

Often, though, it is a third party, the romantically-named software pirate, who is copying and distributing the software of others without remitting the royalties rightfully due to them. The pirate cannot be sued for breach of contract, as there isn't one, so the supplier's main recourse in law resides with his so-called 'intellectual property rights', and particularly copyright.

Legal experts, in the UK and overseas, mainly agree that copyright provides the widest protection for software. Many countries have established that computer programs are capable of copyright protection.

For example, three years ago, the US Congress passed an amendment to its 1976 Copyright Act. This contained a definition of a computer program, and established that programs were 'works of authorship' capable of copyright protection.

Case law has gradually explored the scope of this amendment, and it is now becoming accepted in the US that applications and operating systems software, expressed in any computer languge and in either a human-readable or machine-readable medium, are capable of protection.

The UK, however, is lagging behind, for many software copyright issues have yet to be resolved here.

UK copyright is attractive because the right exists as soon as the work is created, and there are no formalities to be adhered to. Furthermore, since the UK has ratified both the Berne Union and Universal Copyright Convention, copywright owners can readily obtain protection in most countries overseas.

However, the Copyright Act 1956, on which current UK copyright law is based, was drafted when computing was in its infancy. Nowhere is there mentioned 'computer program', let alone 'software'. Furthermore, no case concerning copyright of computer programs has yet been fully argued in the Court of Appeal or House of Lords.

However, the resulting uncertainty should not be exaggerated. A number of decisions have been made generally indicating that copyright does subsist in computer programs. In addition, out-of-court settlements have been based upon the presumption of protection in such works.

Nevertheless, given that a computer program undergoes a myriad transformation, both in its development and execution in a computer, there are unresolved issues. Among these are: it is not clear which embodiments of a program are capable of protection; and for those that are protected, the scope of the program copyright owner's exclusive rights is not clear.

In general, copyright does not give the copyright owner the right to reproduce the work, as it may be based upon earlier copyrighted works. Hence copyright prevents others from copying, and thus is more accurately a negative rather than positive right.

Works capable of protection must be included in one or more classes of work specified in the Act: literary, dramatic, musical and artistic. Conditions for the subsistence of copyright together with the copyright owner's exclusive rights are specified for each class.

The basis for the inclusion of computer programs within the Copyright Act 1956 lies in the interpretation of the term 'literary work'. Programs expressed on paper are probably already covered in this class, but some doubt lingers over machine-readable forms of a program (eg, software in ROM and RAM). A literary work is defined in the statute as including 'any written table or compilation'. The term 'writing' is also defined as including 'any form of notation whether by hand or by printing, typewriting or any similar process'. These definitions can be interpreted to *exclude* machine-readable forms of a program, or they can equally be interpreted broadly to *include* such embodiments.

The uncertainty these inadequate definitions create has long been recognised. The government recommended in its Green Paper on copyright law reform (Cmnd 8302, July 1981) to make 'explicit in new legislation that programs attract protection under the same conditions as literary works'.

Furthermore, in the succeeding paragraph the government proposed that 'copyright should extend to works fixed in any form from which they can be reproduced'.

The implication is that programs in a machine-readable form should be protected by copyright, if they are not already

page 22 ▶

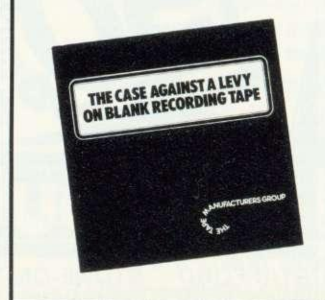
The Pressure Groups

THE Copyright Reform Group was set up this year to persuade the government to introduce a new copyright law. Its first act was to write a letter to the Prime Minister expressing its concern at the 'apparent lack of progress towards a wholesale revision of what is universally acknowledged to be a seriously outdated Copyright Act'.

Signatories included the Guild of Software Houses, British Copyright Council and the Publishers' Association. There are 16 members of the group. Details c/o Roxburghe House (fourth floor), 273-287 Regent Street, London W1R 8BN. To contact GOSH tel: 01-834 8341.

The Software Registry, launched in April, is a private organisation whose aim is to establish and maintain the rights of software authors and copyright holders. This is to be done by providing a date verification for members and advice.

The registry is also hoping to stamp out piracy, and is providing an assurance scheme for members caught up in litigation. Cost for the first five years of registration is £75.75, which also covers a year of basic insurance. Details from: TSR, 57a Lincoln's Inn Fields, London WC2A 3LS, tel: 01-430 0798.



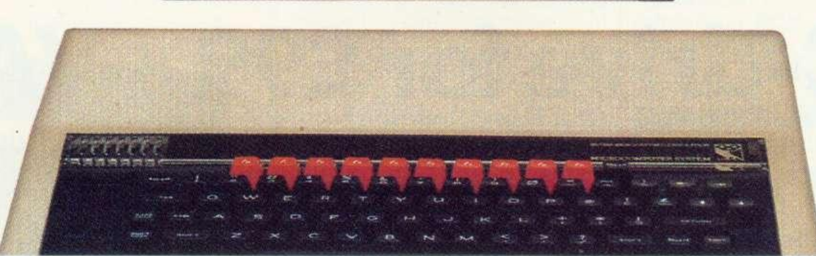
The Tape Manufacturers' Group is fighting against the threat of a levy on sales of blank audio and video tapes. This is one suggestion being put before the European Parliament to attempt to curb piracy of music, video and computer tapes.

The Group was formed in 1981 by BASF, Agfa, 3M, Maxell, Memorex, Sony and TDK. Its main thrust is in the music and video industries.

A booklet *The Case Against a Levy on Blank Recording Tape* is available from the group: Public Relations Office, The Tape Manufacturers' Group, 39-41 New Broad Street, London EC2M 1NH, tel: 01-638 1698.

Unicorn. Five new c
Here's the ful





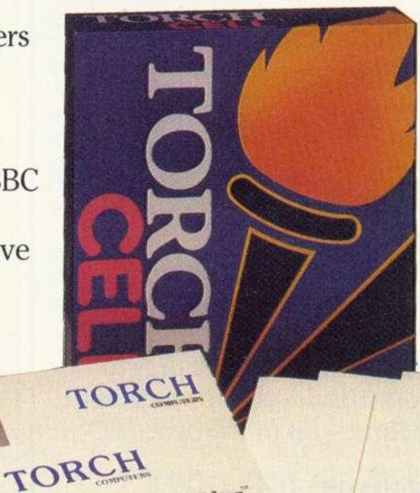


The new UNICORN range from TORCH Computers gives the enthusiast and professional user a choice of upgrades which takes the BBC Model B Micro to the ultimate height of performance.

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4K ROM
win, double sided 400K
loppy discs
ndependent integral
ower supply



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vantage no other BBC micro
grade can offer.
If your BBC micro has the
onet® option, there is a further
nefit the ZDP240 can offer.
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a network, so for enthusiasts,
bs and Schools it is a simple and
v-cost way to achieve networking
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e is provided with the disc pack. It
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d a spreadsheet program, along
h utility programs and manuals.
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For users who need much more storage capacity than is available on floppy discs and who require the large speed gains that a Winchester hard disc provides, the third new channel is now available.
The UNICORN HDP240 combines a 400K floppy disc drive with a 20Mb hard disc and its associated controller. The pack connects directly to the disc and 1MHz bus sockets on the BBC Model B.

In conjunction with a ZEP100, it provides a powerful business computer for running CP/M® programs with large amounts of data. The floppy disc can be used for storage with the Acorn DFS system, and both discs can be used by other TORCH systems on the TORCHNET local area network. **The HDP240 – around £1995 (ex. VAT).**

The HDP68K

● 8MHz MC68000 ● 6MHz Z80B
● 256K RAM (68000)
● 64K RAM (Z80)
● 20 Mbyte hard disc Winchester
● Double sided 400K floppy disc
● Integral power supply

The fourth channel in the UNICORN range is for users who need the extra processing power of a 68000 32 bit processor, as well as the Z80 running standard software. The UNICORN HDP68K provides the ultimate in performance, offering an extra 256K RAM and a 68000 processor running at 8 million cycles per second. It also contains a Z80 processor to allow the running of existing TORCH software.
The HDP68K – around £2495 (ex. VAT).

The Unicorn

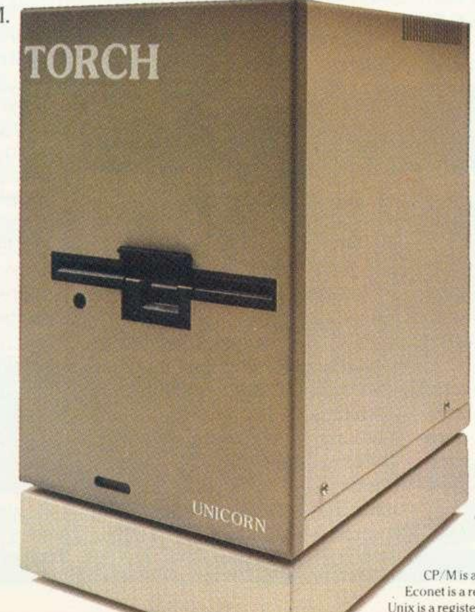
Spec. as HDP68K PLUS UNIX® operating system.

UNIX® System III is the recognised operating system of the '80's. A very powerful and sophisticated multi-tasking system, it includes a vast library of utility programmes.

The fifth channel and top of the range, THE UNICORN, puts UNIX® within reach of the individual user, at a price unmatched by any other UNIX® systems, by combining the reliability of the BBC micro with advanced technology from TORCH Computers.

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Name

Address



CP/M is a registered trademark of Digital Research Inc.
Econet is a registered trademark of Acorn Computers Ltd.
Unix is a registered trademark of Bell Telephone Laboratories Inc.

UK version Model B necessary.
Disc interfaces are necessary for use with the Unicorn range.

Text and Graphics provided by BBC Model B.
Keyboard provided by BBC Model B.



NO, Acorn isn't going into competition with Virgin in the airlanes, this is just the company's equivalent to the Presidential plane. It's a Cessna 337 'push me, pull you,' so nick-named because it has two engines, one behind the cockpit, the other in front. The Cessna can carry six people, just the thing for transporting high-flying millionaires around.

ITV answer to Ceefax magazine

ORACLE, ITV's viewdata service, is to launch its own computer news and magazine section in June.

The service will be called Database and include news, viewers' letters, events, a games chart and software reviews. The reviews will be done by a special Oracle panel chosen from viewers.

Database will be found on page 558 of Channel 4 Oracle.

Database will be ITV's answer to REM, the magazine run by Ceefax, the BBC's version of viewdata, which has been operating for more than 18 months.

However, there will not be an equivalent to the BBC's Telesoftware Service to accompany the magazine. 'We have no plans to broadcast telesoftware at the moment,' said Oracle editor David Klein.

Now Elk gets Simon sprites

SIMONSOFT has released its *Sprites* package, reviewed last month, for the Electron. It gives generator programs for user-designed sprites, enlargement of up to five times normal sprite size, supersprites of up to 24 × 24 pixels, collision detection, preset flight paths, instant animation and a library of ready-designed images.

The package is claimed to give a 14-fold speed increase over Basic and costs £12.95.

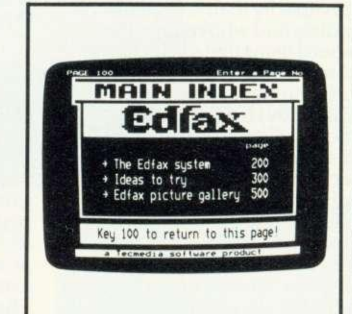
MICROGAME'S 'Dodg'em' package, reviewed on page 141, costs £5.95.

Teletext mimic for classroom

EDFAX is a teletext emulator for the BBC micro which lets you mimic a teletext database such as Ceefax or Oracle.

Tecmedia, which produced the Input and Microprimer packs for the MEP, are aiming the program at schools that might wish to set up their own teletext system. However, it is also seen as having a role to play for displays in shops or at exhibitions.

Edfax allows users to set up and edit a display, which can be stored on disc and linked to other pictures or text.



The program is provided on disc and up to 80 'pages' can be stored on one 40-track disc. An extensive manual is provided with the program, as well as a disc of example images.

Tecmedia claims that 500 copies have already been ordered by schools in the Midlands where the software underwent trials.

The Edfax package costs £34.68, but schools will be given a discount on that which amounts to about a third.

Details from Tecmedia at 5 Granby Street, Loughborough, LE11 3DU. Tel: Loughborough (0509) 230248.

Computerised garden

LIVERPOOL'S International Garden Festival will be the testing ground for a computer information system featuring the BBC micro.

The micro will be at the heart of a network of 18 television sets scattered around the 125-acre site, giving visitors information and a catalogue of each day's events.

Information about the Festival will be input to the system on a Rotavision Editing Station sited in the main hall.

ITM, the company behind the system, is hoping that its development will see much wider application in hotels, airports and railway stations.

For details of the system, contact ITM at E3 New Enterprises, SW Brunswick Dock, Liverpool L3 4AR. Tel: (051) 708 9066.

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◀ *page 18*

protected. However, these recommendations have not been acted on, so the situation is still uncertain.

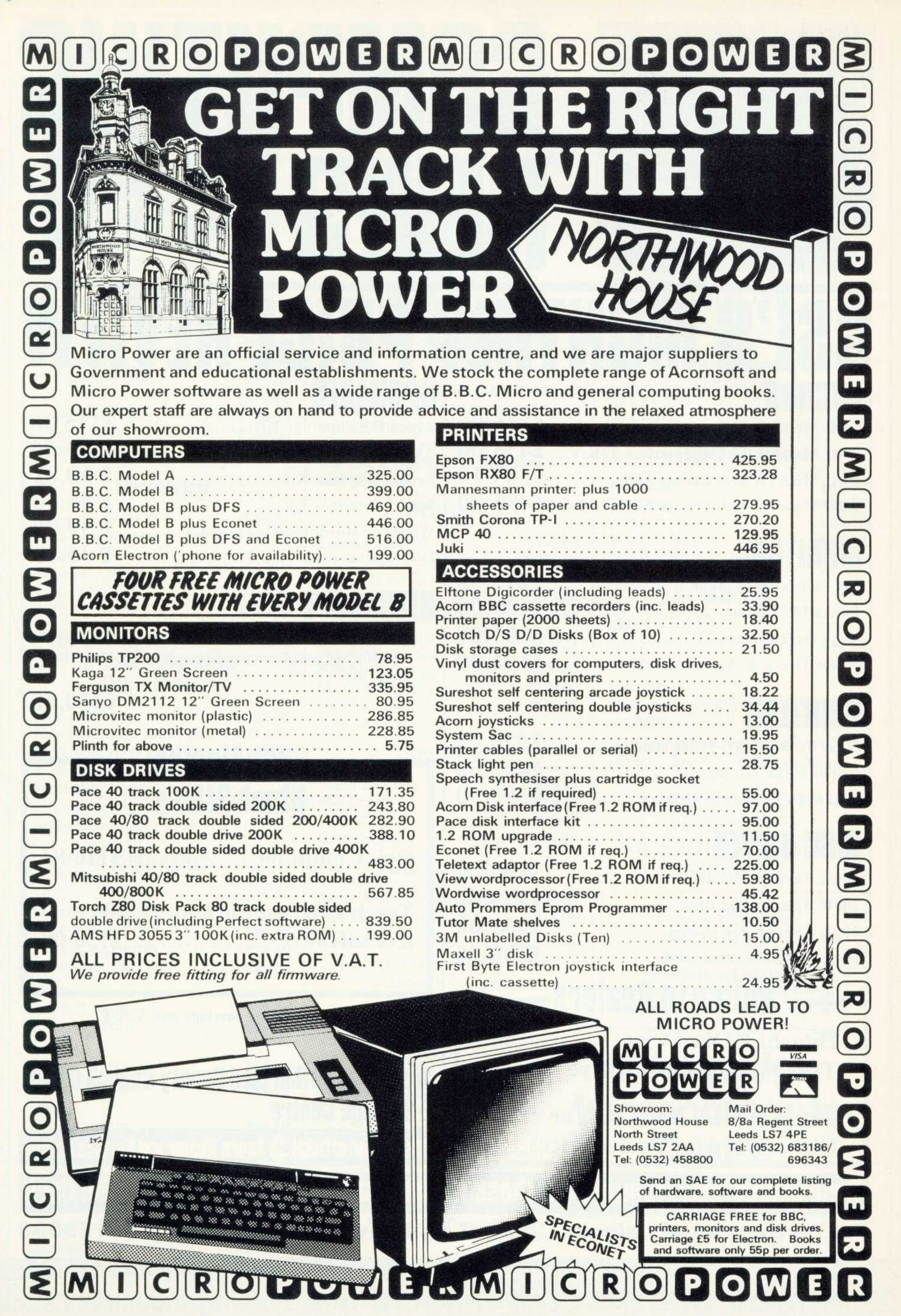
Although computer programs have yet to be considered in the High Court, they have cropped up, albeit briefly, in *Sega Enterprises Ltd vs Richard* (1983). This case concerned an alleged infringement of copyright in a video game program called Frogger, each copy of which was embodied in an EPROM (erasable programmable ROM). The judge said:

> 'On the evidence before me in this case I am clearly of the opinion that copyright under the provisions relating to literary works in the Copyright Act 1956 subsists in the assembly code program of the game 'Frogger'. The machine code derived from it ... is to be regarded, I think, as either a reproduction or an adaptation of the assembly code program, and ... I find that copyright does subsist in the program.'

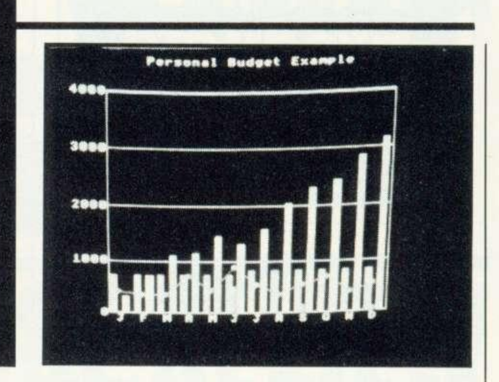
Although the judge was unsure which act applied, he was convinced that a machine code form of a copyrighted assembly code program was included in the scope of the restricted acts. This wide interpretation was underlined in the aforementioned Green Paper, for the Government stated that, in its view, the various transformations a program conventionally underwent when run in a computer were already covered.

The effectiveness of copyright law is judged by whether it deters would-be infringers. Clarification of the statute would undoubtedly enhance its effectiveness. However, deterrence also implies a copyright law which is easy and cheap to enforce, and where the remedies granted are punitive in nature. Although the courts have granted what amounts almost to a civil search warrant in software copyright cases, the penalties for infringement are woefully inadequate. In particular, the Act specifies that the guilty defendant should be liable to a fine not exceeding 40 shillings for each article to which the offence relates. An increasing number of organisations advocate a change in the law to increase financial penalties for copyright infringement of computer programs. If enacted, this may do much to deter the ever-present threat of widespread software piracy.

Dr Elsom, a software protection consultant, is secretary of the Copyright Committee, British Computer Society.


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BUSINESS BUNDLE



What will the Z80 second processor – and the free batch of software that comes with it – do for the Beeb's serious business user?

THE BBC micro has long had the potential to become a business machine and now with the appearance (at last) of the Z80 second processor it has the technology. The Z80 will run CP/M (control program for micros), which has become the standard operating system for running business programs. Software houses all over the world have written programs to run on CP/M machines which, potentially, can run in the 64k provided by the BBC micro with a Z80 second processor.

Acorn has thoughtfully provided a bundle of free software with the hardware. Here the portability of CP/M can be seen, as half of it has come from the US. The programs cover a range of applications, including word processing, filing, financial modelling and writing dedicated software. Three programming languages are included: BBC Basic; Mallard, a Microsoft-type Basic; and CIS Cobol, a business language.

But first let's look at the hardware provided for your £300. The second processor itself comes in the same bland box as the 6502 version reviewed last month, and the Teletext Adaptor before that. It matches the Beeb in colour and finish, being the same depth and height, but half the width. This links to the Tube, Acorn's patented high-speed interface, underneath the Beeb by a short cable, which dictates that the Z80 must sit on the immediate right of the micro. The manual suggests that a desk area of 5ft wide by 2ft 6in deep is needed for the hardware, plus at least four power sockets.

When you open the box you'll find a DNFS ROM provided which is a combined version of the disc and Econet filing systems.

The issue of CP/M is 2.2 with BIOS 1.0 (this is the input/output part of the operating system). Although CP/M is a standard business operating system, there are different implementations on various machines. Acorn is using CP/M under licence from its US owners, Digital Research. CP/M has its own disc operating system, which will handle up to 128 directory entries per disc.

The software comes on seven discs in CP/M format. A list of the major items is given in figure 1, with the companies behind the programs.

The manuals for the software and the user guide (apart from the standard CP/M manual) were produced by Baddeley Associates of Cambridge, which has an excellent reputation in this area. Its efforts for this package certainly uphold its reputation, most of them being far better than the original guides written by the software houses involved. The manuals have gone through several stages of rewriting and do a good 'hand-holding' job with detailed examples of the software in use. The text examples are backed up by data files on disc that again demonstrate the time and thought that have gone into this package.

Acorn believes that the package will turn the BBC micro into a fully fledged business machine. But how well does this claim stand up? Figure 2 gives some cost comparisons against the Torch Z80 pack and an Apricot. An 800k disc drive is needed to run the system (dual, double-sided, 80-track) and, of course, a monitor. All of that adds up to between £1300 and £1700 (mainly depending on the disc drives).

This is comparable to the Torch and the Apricot, which boasts a much larger

Q/A SESSION

Acorn User probes Howard Fisher, head of the Z80 project, on the capabilities of the system

AU *How much CP/M software will the Z80 second processor actually run?*

HF Virtually all the CP/M eight-bit software will run. We've tried out as much as we can lay our hands on, including *dBase II, Wordstar, DRGraph,* and the Perfect and Compact ranges. We are taking a lot of trouble to make sure this does work.

AU *Can the Z80 be networked?*

HF Yes it is possible, and we are working on it at Acorn. The system will also support Acorn's Winchesters when they become available.

AU *Will BBC programs transfer onto the Z80?*

HF Yes, you can transfer BBC programs to CP/M. If you have a BBC program (as long as it contains no assembler) it will most likely run on the Z80, so you can take advantage of the CP/M disc filing system, which is much better than the Acorn DFS for random access filing. Data and program merges can give problems, but well-written software will transfer.

AU *How well tested is the software and documentation?*

HF We have tried it out in small businesses for comments. While it's not exactly 'passed by morons' it should be close to it.

We started off with the idea of modifying the original documentation, but ended up rewriting a lot from scratch. We've put in about two man years of effort humanising the manuals. The *Accountant* guide was written from scratch because Compact did a lot of updating of the original software. The CP/M manual is a reproduction of Digital Research's. We didn't think we could have done anything better. However, for simple uses, the Z80 user guide can replace the Z80 manual.



The second processor, shown with the family of business software, sits to the right of the host micro

memory, better discs, service back-up and a wide repertoire of tried and tested software. However, where the BBC stands out is in the free software which, in the words of Acorn boss Hermann Hauser, the company 'scoured the world for'. All three machines demonstrate the trend towards giving away software to start users off, but Acorn's estimate of £3000 to buy its bundle takes some beating – and it's good stuff (figure 1).

Acorn has kept the price of the Z80 a close secret, and withdrew an original tag



Humble pie? Acorn User does its homework on 'Graph Plan', output on an Epson FX80 printer

of £225 given out a year ago on official price lists. This was no doubt a reaction to the likes of Torch, whose success with products based around Acorn's own boards must be galling. The arrival(?) of Sinclair's QL and the plummeting cost of machines like the Apricot no doubt helped persuade Acorn to keep the price down.

Another option for those who already have a BBC micro is to invest in the 6502 second processor and wait for some quality software to appear. The 6502 is reckoned to be the second-fastest microprocessor in the world and has 22k to play around with in 80-column mode.

There wasn't time to do a full review of the Z80 software, which will have to wait for another issue, but we can run through some initial impressions (PCW is running a series of reviews based on early versions of the programs).

First, let's tackle *Nucleus*, the 'system generator'. The flexibility of this makes it possible to develop packages at least as good as most of the business programs currently available for the standard BBC micro. The great advantage is that the packages will be customised to the writer's own use, down to the last field or record. By following Acorn's documentation, the first-time user can be producing worthwhile examples within an hour.

NUCLEUS

The idea behind *Nucleus* is to help users without much programming experience to write custom software. The package is straightforward to use – but what it will not do is the thinking behind how a database should be structured. You must be familiar with the concept of files, fields and records and how they interact. If you aren't, then you're in for a hard time, although working through the examples will give some idea.

Where problems will crop up is in linking files, especially as this topic won't have cropped up unless the programmer has coped with file handling in some depth.

Nucleus gives small firms and dealers an opportunity to create programs and sell them to others. A whole new industry could spring up here, and this is, in fact, exactly where Compact got the idea from (see figure 1). At the moment however, there are no firm plans for Acorn itself to do this.

The ideas offered by Compact in its own leaflets include records covering personnel, schools, medical, stock and invoicing.

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Product	Originator	Description
Accountant	Compact Accounting Services (UK)	Nominal Ledger
Nucleus	Compact Accounting Services (UK)	Database creation
Memo Plan	Chang Laboratories (US)	Word processor
Graph Plan	Chang Laboratories (US)	Spreadsheet with graphics
File Plan	Chang Laboratories (US)	Data filing system
CIS Cobol	Microfocus (UK)	*CO*mmon *B*usiness *O*rientated *L*anguage
Animator	Microfocus (UK)	Cobol debugging utility
Forms 2	Microfocus (UK)	Cobol screen layout utility
Z80 BBC Basic	Acorn/BBC	Disc version to run under CP/M
Mallard Professional Basic		Microsoft-type Basic
CP/M 2.2 with GSX graphics	Digital Research (US)	Z80 operating system

All the software comes contained on seven discs, with separate guides to each. The discs also contain sample data for some of the programs.

Figure 1. Z80 software bundle

BBC Z80 system running CP/M 2.2		
BBC micro with disc interface		£470
Dual 80-track disc drives (800k)		£450-£800
80-column monochrome monitor		£100
Z80 second processor		£300
	Total cost	£1320-£1670
	Estimated value of software inc.	£3000
Torch Z80 system running CP/M	Total cost	£1409
	Estimated value of software inc.	£1000
Apricot running CP/M 86 and MS-DOS		
16-bit processor, 256k RAM, twin single-sided 3½in disc drives (730k), separate keyboard, monitor	Total cost	£1890
	Estimated software inc	£750

Figure 2. Three-way cost comparison of hardware/software combinations.

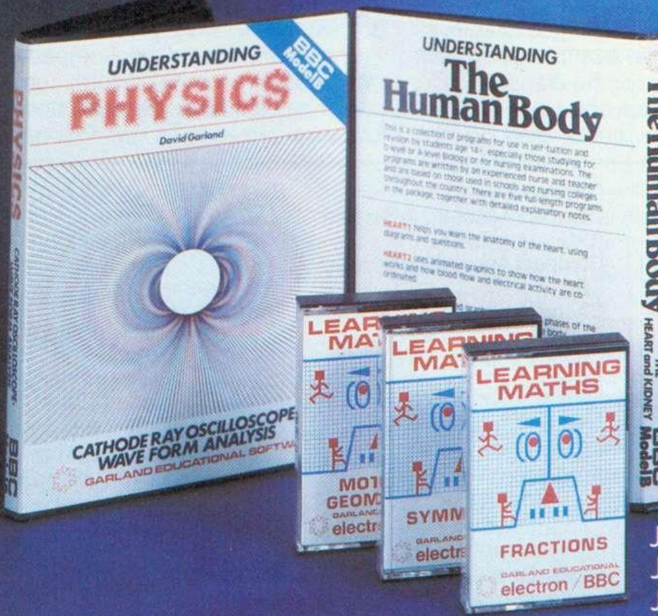
If you're studying...
Study our Software

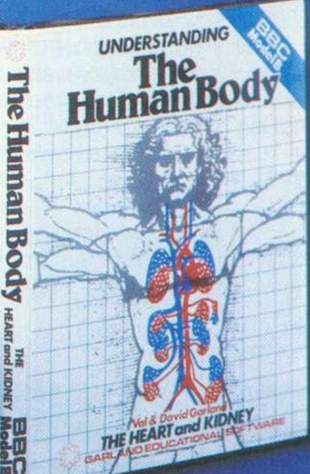
We've been producing educational software for the BBC micro ever since it was launched, and our programs are in use in schools and colleges all over the country. Now, some of these programs have been specially adapted for you to use at home.

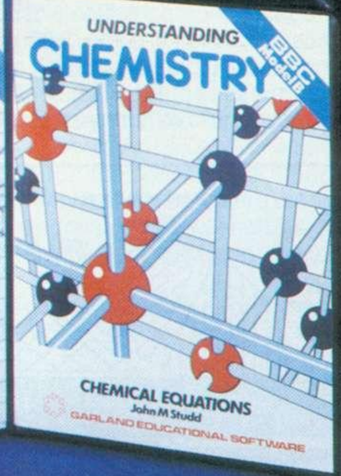
With our **Understanding Science** programs you can get to grips with subjects in Biology, Physics or Chemistry that you didn't understand, or supplement your practical work by doing simulated experiments on the computer. These programs are suitable for age 13+ and are ideal if you are studying for those all-important exams. The emphasis is on **understanding** the subject and the programs come with a detailed explanatory booklet. The first programs are ready now — with many more to follow.

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Chemistry — Inorganic Analysis and Identification of Gases
Physics — The Oscilloscope and Waveform Analysis
The Human Body — Heart and Kidney

Each package costs £12.95 (cassette) or £13.50 (disc).







For younger pupils age 9+, our **Learning Maths** programs use simple games and animations to illustrate important principles of elementary Maths. There are nine titles — each containing three or more programs covering a particular concept. The programs are great fun to use — as well as providing real educational value.

Nine cassettes are available*

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JM2 **Directed Numbers**
JM3 **Fractions**
JM4 **Co-ordinates and Lines**
JM5 **Symmetry**
JM6 **Motion Geometry**
JM7 **Sets**
JM8 **Elementary Statistics**
JM9 **Ratio**

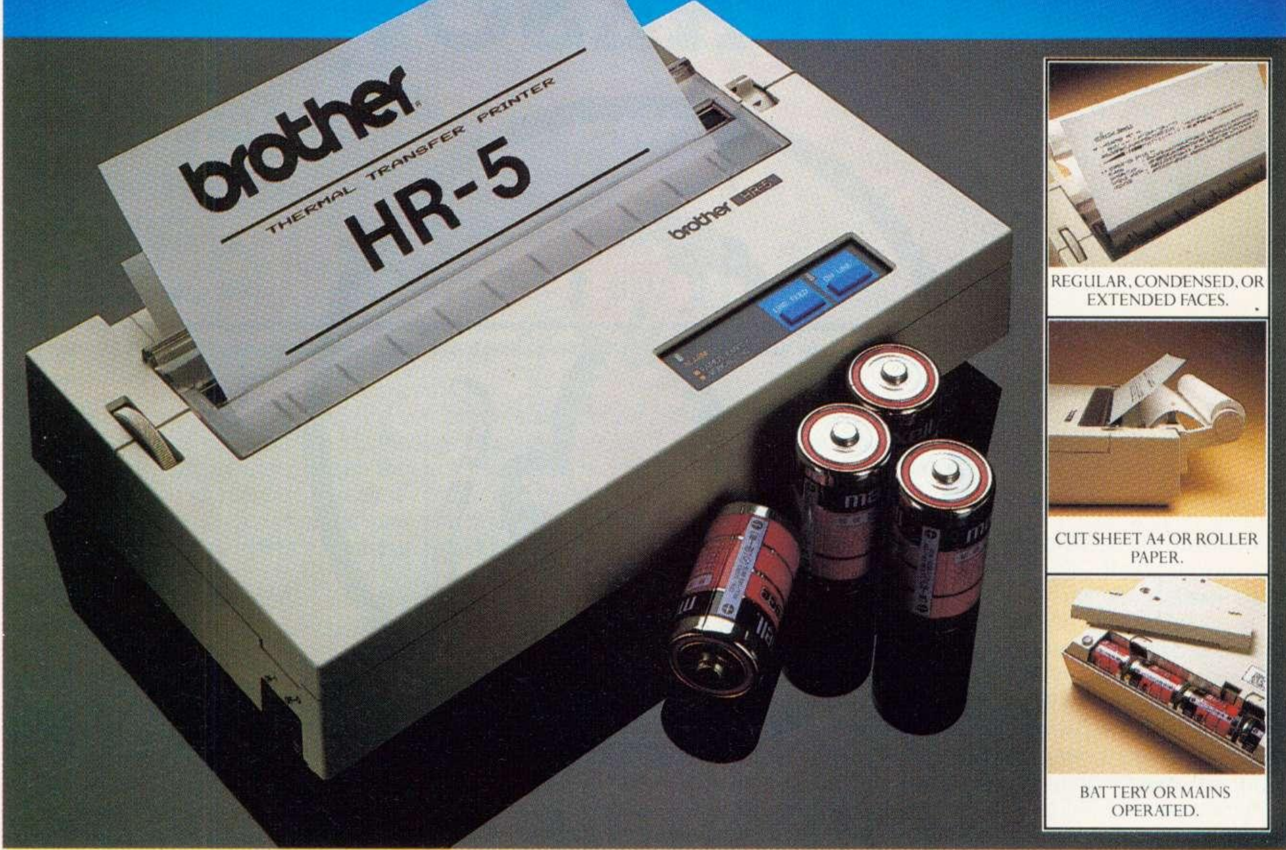
Each cassette costs £7.00. Disc collections also available (JM1-6, £30.00; JM7-9 £18.00)

*Electron versions of programs JM1-9 and Dragon versions of JM1-6 also available.

Available by direct mail order, or from selected software dealers.
Prices include VAT and P&P (in UK).

Garland Computing 35 Dean Hill, Plymouth PL9 9AF. Tel: (0752) 41287

Little Brothers should be seen but not heard.



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But there's one thing the HR-5 won't give you.

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For the annoying 'clickety clack' many printers produce is mercifully absent from the HR-5.

Quietly efficient, it delivers high definition dot matrix text over 80 columns at 30 c.p.s.

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Being capable of producing uni-directional graph and chart images together with bi-directional text.

It will also hone down characters into a condensed face, or extend them for added emphasis.

Incorporating either a Centronics parallel or RS-232C interface, the HR-5 is compatible with most home computers and popular software.

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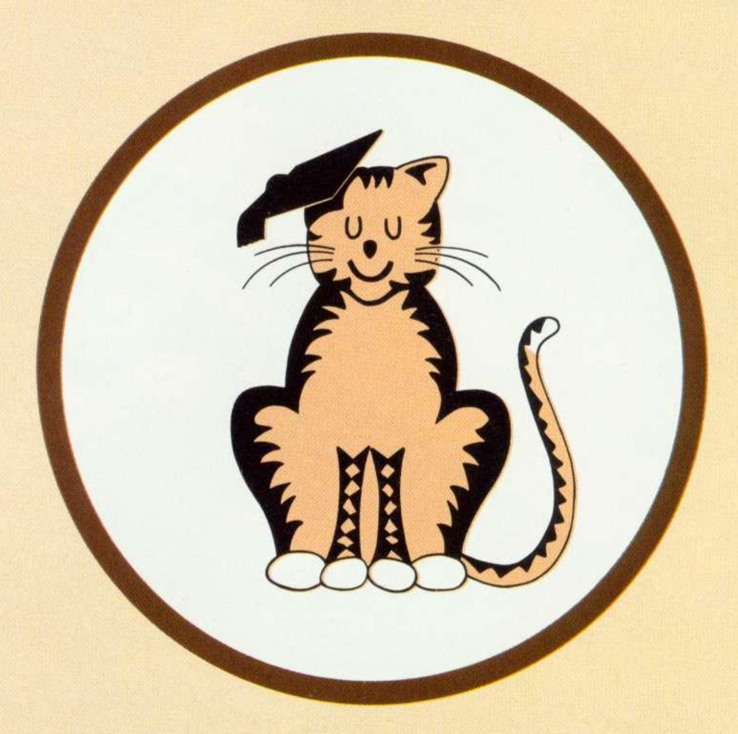
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COMPACT NUCLEUS FILE DEFINITION

SYSTEM NUMBER 21 SCHOOL RECORDS
FILE NUMBER 1 STUDENT FILE

BASIC FILE NAME	SSFILE01
FILE TYPE	Master
RECORD LENGTH	220
NUMBER OF RANKS	1
NUMBER OF RECORD TYPES	1
FILE PROTECTION	None

FIELD NO.	DESCRIPTION	FIELD TYPE	NUMBER OF CHARACTERS	DIGITS BEFORE POINT	DIGITS AFTER POINT	ALLOW NEGATIVE VALUES	MINIMUM VALUE	MAXIMUM VALUE	NUMBER OF LINES	DELETE PROTECT	START BYTE	LTH	BASIC NAME
1	STUDENT CODE	Numeric		4	0	N					1	2	DA%
2	NAME	Alphanumeric	30						3		3	90	DA$
3	ADDRESS	Alphanumeric	30						4		93	120	DB$
4	FORM NUMBER	Numeric		3	0	N					213	2	DB%
5	DATE OF BIRTH	Date									215	4	FO!
6	ABSENCE TO DATE	Numeric		3	0	N					219	2	DC%

KEY NO.	KEY DESCRIPTION	NUMBER OF CHARACTERS	RANK NO.
1	STUDENT CODE	4	1

Example from the user manual of a database devised with Compact's 'Nucleus' package

◀ *page 27*

GRAPH PLAN
Probably the easiest and friendliest of the whole bundle. It's a spreadsheet with the rare ability to give graphical representation of its rows and columns as pie-charts, bar-charts and graphs, without any heartache. It is set up for the Epson FX range of printers (although it does strange things with the Star Delta, which has the same control codes). Other printers will be supported.

This is the only piece of software in the package that supports colour.

The maximum number of cells supported is 1000 as 50 rows by 20 columns, the size of each being definable within this limit. The figures in these cells can be manipulated as in any other spreadsheet. The split-screen facility of Visicalc is not supplied.

MEMO PLAN
Memo Plan is a word processor. One of its main features is that it automatically saves text every few minutes, and the user can carry on working as this happens. Two documents can be displayed on the screen at the same time, the display being split horizontally, and another three can be held in memory and called up to replace one of the two on the screen.

The use of function keys is just as comprehensive as View's.

Memo Plan does not support continuous processing, so you have to stop typing while the screen is being printed out.

One of the big advantages of *Memo Plan* over the likes of View and Wordwise is that it is set up to cope with long documents. At the start of a typing session space can be reserved on disc for the equivalent of, say, a 50-page document, and the manual explains how to work out the memory required.

The system is configured for the Epson printers as a default, although another 20 are covered, any of which can be selected.

Docuplan is an addition to *Memo Plan* that can cope with long indexes and can format text. It will be available at about £150.

ACCOUNTANT
'Simple but flexible' is the description in the manual for this program, which has three main parts: sales daybook, purchase daybook and cashbook. These can then be built up into a nominal ledger. However, *Accountant* is one of the heavyweights in the bundle and has already earned itself a good reputation on other micros. Compact has substantially expanded the software from the original version, improving its credit-handling side.

It is aimed at the small shopkeeper and the system can be built up using other packages available from Compact to cover invoicing, sales ledger and bought ledger.

VAT reports are generated from within the daybooks, and up to 10 different rates can be entered. Companies that prepare budgets are also catered for.

Users who do not have accounting skills will be pleased to find a glossary at the back of the *Accountant* guide, but even so, transferring a complete paper system onto the package would be no easy matter. Acorn is apparently arranging training courses for dealers, who may set up similar help for customers.

FILE PLAN
This is what is known as a 'viewsheet', in other words a database presented as a number of record cards on the screen. It is similar to a spreadsheet, but with words instead of numbers filling the cells.

The whole thing is menu-drive, with options for sorting and updating records. Files created on *File Plan* can be printed out, or used to produce labels by linking to *Mail Plan*, a complementary part of the package.

BASIC
Two versions of Basic are provided. One is a version of BBC Basic which runs on CP/M, the other is Mallard, a more standard Microsoft-type Basic.

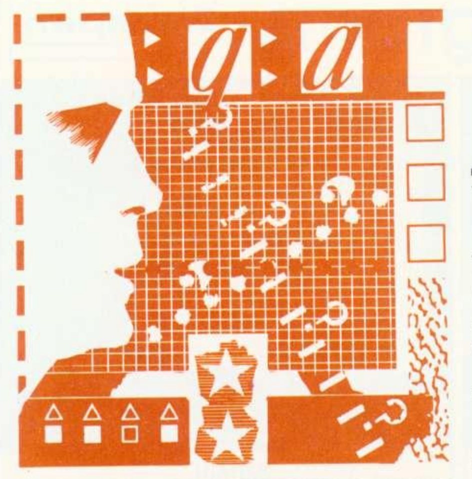
The BBC Basic on disc leaves about 40k, in any mode, for user programs. It is close to the 6502 version, but there are differences, which are outlined in the Z80 user guide. Commands can be passed to the 6502 operating system, but these are checked for as Z80 commands first.

Utilities are included to change BBC discs to CP/M format.

CIS-COBOL
The Cobol is provided by Micro Focus, and comes with *Animator*. Using this debugger enables Cobol programs to be stepped through line by line and checked for errors. Cobol, a widely used language for writing business programs, enables input to be tightly defined, although this does make it long-winded to use. *Forms 2* is a screen layout facility.

GSX is a graphics package that is not actually used by any of the bundled software. It is designed for use with the Digital Research *Graph* package, which can be bought from computer dealers.

To sum up, Acorn has put together an excellent and versatile system that has something for everyone. The level of the packages varies, some demanding a high standard of knowledge and expertise, others being easy to get into. The value of even one of the packages could justify its cost to a buyer. Certainly it gives an excellent introduction to the world of CP/M and gives the would-be computerised businessman a foundation on which to build an excellent system.



Martin Phillips dons carpenter's overalls to produce a computer tidy and carrycase for the Beeb ... plus circles, strings, spikes

Your Beeb – with everything in its place

FOR something slightly different, here's a simple project to build a simple computer tidy and a portable box to contain a complete BBC computer system.

The computer tidy will keep your computer and cassette recorder or disc drive looking tidy, provide a suitable monitor support and avoid the need for constantly disconnecting leads. It is constructed from two pieces of softwood and two pieces of white-faced chipboard (the sort sold for shelving), and can easily be dismantled if required.

The sides are made from 6 x ⅞in planed softwood as shown in diagram 1. The curved parts can be cut with a jigsaw or coping saw. Once cut and sanded, they look most attractive if varnished and contrast well with white-faced chipboard. The correct length for the chipboard will depend on the width of the computer plus the width of the cassette player or disc drive. Remember to allow extra length for the leads to come out of the cassette. For the BBC cassette, allow an extra 2in at each side for the mains lead and the signal lead. The BBC computer is 16in wide and the BBC data recorder is 10½in. On this recorder the mains lead is at one side and the signal lead at the other, so an extra 4in needs to be allowed for the leads, so the minimum width of the tidy is 30½in. A reasonable width to cut the chipboard would be 32 inches.

Most disc drives are 6-8in wide, and so a tidy for a system witha disc drive should be about 24in wide. Check measurements carefully before cutting any parts, and check that there's enough height if using double disc drives. Some might be too high to fit into the computer tidy with the measurements given.

The sides can be joined to the white-faced chipboard by using 'harpoon' fixings. These can be obtained from good hardware shops and are designed for chipboard fixing. They are very strong, consisting of a hexagonal socket screw and a special nut that opens up inside the hole in the chipboard like a harpoon. Once fitted, the screw can easily be removed and replaced without affecting the strength of the joint. Harpoon fixings are expensive but make assembly easy. The ends of the white-faced chipboard do not need finishing as they are covered by the sides of the tidy. To prevent the computer and cassette sliding about, glue battens behind them. You can do this with the computer and cassette in position.

At the back of the lower shelf a mutli-socket adaptor can be screwed to keep all the wiring neat and tidy. Lastly, four self-adhesive rubber feet need to be stuck under the base. If constructed as described above, the tidy is strong enough to support a monitor or portable TV. It also puts the monitor in an ideal position.

The computer box is similar in design but enables the computer to be packed away quickly and moved without having to disconnect everything. It also provides good protection for the computer. Rather than using chipboard, the box is constructed of softwood and good-quality 9mm plywood. There is no need for the harpoon fixings; the joints are glued with woodworker's adhesive. This is stronger than the wood, and saves any screwing or nailing.

The box has a compartment at the back with a miniature multi-socket mains connector (the kind commonly used to connect up stereo systems) and there is room for all the leads to be stowed. The box will also support the weight of a monitor.

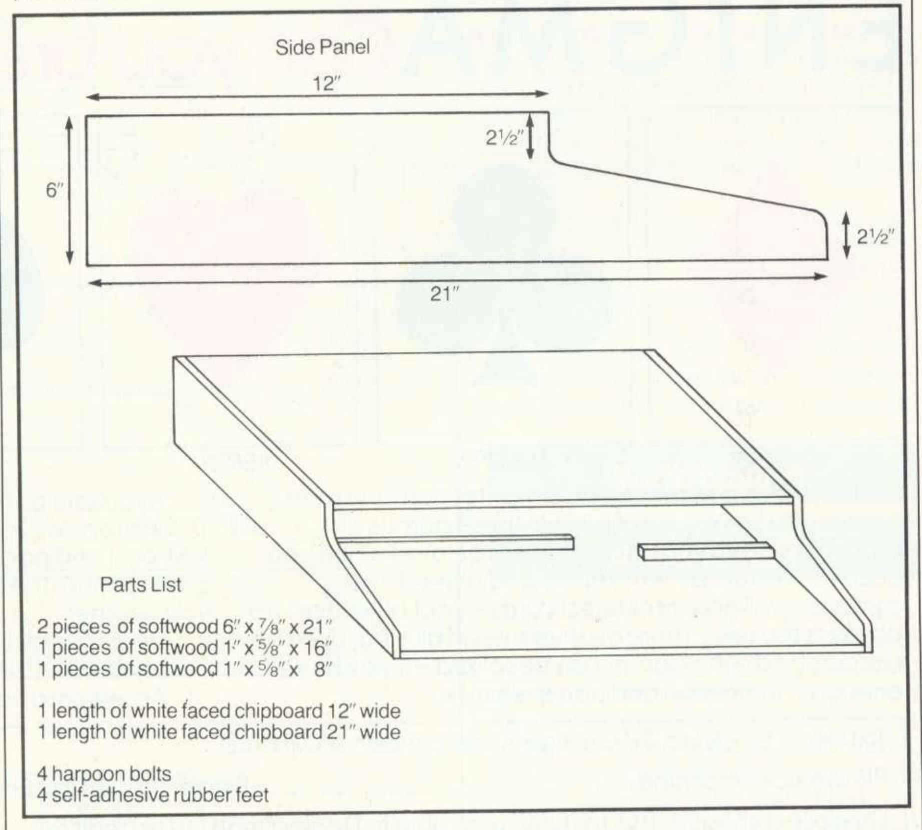


Diagram 1. Simple computer tidy

IF YOU have a technical hitch or a programming problem let Martin Phillips give his diagnosis. We'll pay £5 if you raise a really interesting point. Please give full details of the system you're using and include a listing where appropriate, making your question as specific as possible. WRITE TO: Hints & Tips, Acorn User, Redwood Publishing, 68 Long Acre, London WC2E 9JH.

The front of the box lifts off to expose the computer keyboard and cassette or disc drive. The sockets at the back of the computer are all accessible from the compartment, and the ones most frequently used have been brought out at the side of the box, which saves wear and tear on the computer sockets. The new sockets are wired to plugs, which then go into the computer sockets, so the computer does not need to be touched. In my case I have brought out the RGB, cassette and analogue port sockets. A printer lead can remain attached to the computer and be disconnected at the printer end and stowed in the box for transportation.

As the box needs to be small enough to be carried, it is not as deep as the computer tidy. This is why plywood is used rather than chipboard, which is too heavy. Again, the exact width of the box will depend on the dimensions of the disc drive or cassette player. Thought must also be given as to how the cassette or disc is to be held in place when the lid is in position. As my disc drives are almost the exact internal height of the box I simply glued a thick foam pad inside the lid to hold them down when the lid is closed.

The catches need to be strong, and they must be well fastened to the box to stand up to the strain. If using a single disc



drive or a cassette, it might be better to fit a shelf to raise the disc or cassette up. The space under the shelf could be used to hold the *User Guide*.

There is an internal partition separating the lead compartment from the computer. The computer is held at the back by a batten glued to this partition. The cutouts in the partition allow access to the computer sockets and the mains switch and clear the ventilation slots at the back of the computer. There is a cutout at the back so that leads can be passed out of the box, and a handle is screwed to the back (this needs a metal reinforcing plate inside the box).

The lid has a batten at the front to hold the computer in place. This rests on the front of the computer in front of the space bar. Do not make the batten too large or it could damage the space bar. Once the lid has been removed, the computer is easy to take out. The lid is fastened to the box with removable hinges and stout suitcase catches.

Once complete the box can be varnished or painted, and rubber feet stuck onto the front of the lid and under the base. The measurements are a guide only and you must check that your system will fit. My apologies to those readers who prefer to work in metric, but most of the wood sizes have not yet been metricated!

Side View

Batten to hold computer down at front. (Glued inside lid)

5″ 12″

19½″

Batten to hold computer down at back

Partition

3″ 5½″

¾″ 2½″ 1½″ 10½″ 1½″ ¾″

Parts List

2 sides	softwood	6″ x ¾″ x 18″
1 front	softwood	6″ x ¾″
1 back	softwood	6″ x ¾″
2 battens	softwood	1″ x ⅝″ x 16″
1 partition	9mm plywood	5½″ high
1 top panel	9mm plywood	18″ deep
1 bottom panel	9mm plywood	18″ deep

2 pairs lift-off hinges
2 magnetic catches
8 rubber feet
2 suitcase catches
1 handle
1 piece thick foam rubber

Diagram 2. Portable box for Beeb system

Worth buying a disc drive?

MANY schools have now received their half-priced DTI BBC computers complete with disc interface and a somewhat useless Econet interface. The question frequently raised by teachers in such schools is: 'Is it worth buying a disc drive?' As this is a problem also facing home users, especially now that drives are available over the counters of many high street stores, it is well worth airing here.

Many users are frustrated by the cassette recorder and think a disc drive is the answer to all their problems. I have listed some of the advantages of both storage systems and highlighted some of the problems associated with disc drives.

No doubt readers who have recently changed to discs will be able to enlarge this list. It is not meat to put the reader off disc drives, but I hope it will give a better insight into the problems that will need to be overcome.

Advantages of disc

1. A program loads much quicker from disc, almost instantaneously.
2. Many programs can be stored on one disc.
3. It is easier to find what programs are stored on disc.
4. It gives the advanced computer user a useful extra range of facilities, and opens up new techniques.

Advantages of cassette

1. A cassette recorder costs less than £30 to buy and requires no special interface. A disc drive costs from £170 upwards and requires a disc interface to be fitted (another £100+). A disc interface is a collection of chips that plug into some of the spare sockets on a model B computer to enable a disc drive to be connected. One of the chips that deserves special mention is the DFS (Disc Filing System). It is a clever chip that performs all the 'housekeeping' tasks required on the disc. Several different makes of DFS are available, each with its advantages and limitations.
2. A blank C15 cassette costs about 50p, whereas a blank disc costs £2 – although a disc will store far more information. This price difference is reflected in the cost of commercially available software on disc or cassette.
3. Cassettes can be handled quite roughly and still work, but discs need careful handling if they are not to be damaged.
4. A cassette player can be repaired comparatively cheaply if it goes wrong, whereas a disc is a piece of precision equipment and is expensive to repair. Only a few dealers will undertake repairs to disc drives; most will need to send them back to a service agent.
5. Broken leads are a common problem. It costs £2 for a new cassette lead, but £12 for a new disc lead, and this requires fitting by a dealer.
6. The cassette socket on the computer is more robust than the disc connector. The latter can be easily damaged by careless handling.

'Hidden' problems of disc

1. A disc drive has an extra set of commands, which give it versatility but also add to the problems of understanding an already complicated machine.
2. To operate, the disc drive uses some of the BBC's memory space. This leaves less for the user, so some long programs designed for cassette will not work on a disc machine, although the problem can be solved with time and a little knowledge.
3. Which disc system do you go for? Forty-track or 80-track, single or double-sided, single or twin drive, or even one of the new 3in drives? Each has its advantages and disadvantages, but they are not interchangeable. Do you rely on the BBC's power supply to drive it, or invest in a more expensive drive with its own power supply?
4. Many cassette programs are now protected and cannot be transferred to disc.
5. Discs can be corrupted so that you are unable to retrieve the programs from them. This can happen if the disc drive is switched off at the mains while the disc is still in the machine. The information stored on the disc cannot be retrieved without a great deal of trouble and expertise if this happens. Many of the newer types of disc drive have virtually overcome this problem, but some makes are worse than others in this respect.
6. Discs need to be formatted before use. This is done with a program, usually supplied with the disc drive.

Going round in circles

IT WOULD have been useful to have a routine built into the computer to draw circles and ellipses. T Poole of Glasgow has written to ask how circles can be programmed, and I've received several other letters asking for ways to speed up circle drawing.

There are several ways of drawing circles. The first is called the iterative method, and as it is not easy to see how the method works, attempting to alter it can produce odd results.

The second method uses the equation of a circle. The equation of a circle about the origin is $X^2 + Y^2 = R^2$. This would be programmed as X*X + Y*Y = R*R where X is the horizontal co-ordinate, Y the vertical co-ordinate and R the radius. Rearranging this equation, we get Y= SQR (R*R−X*X). Thus if we know the radius and use set values for X, we can find the value of Y.

Listing 1 (yellow page i) shows how this can be done. Line 20 sets the time to 0. Line 40 moves the graphics origin to the centre of the screen. Line 50 sets the radius of the circle to 400. Lines 60 to 130 need to be repeated twice, first to draw the upper (positive Y) half of the circle, and then to draw the lower (negative Y) half.



Line 100 makes Y negative if T=1. The step length for X is set in line 80 to a value of 8. Line 90 calculates the value for Y, and line 110 draws a line from the last point to the new co-ordinates.

To draw an ellipse, all that is needed is to multiply either the X value or the Y value by a factor somewhere between 1 and 2.

The program can be speeded up by using integer variables instead of real variables (an integer is a whole number and can be positive or negative, whereas a real number can contain a fractional part). Listing 2 shows how this can be done, and also uses a neater method of making Y negative. A small saving in time can be made by doing any repeated calculations only once.

Listing 3 moves the squaring of the radius outside the loop to save a little time. More time can be saved by entering the equation to find the value of Y% directly into the DRAW statement. And yet more time-saving can be made by decreasing the number of points plotted.

The circle retains its shape provided the step size is not larger than 20 (listing 5). The step size for any particular circle will change depending on the screen mode used and the size of the circle. It will be a compromise between the quality of the circle and the speed of drawing. Table 1 gives a comparison of speeds on both the Electron and the BBC.

	ELECTRON	BBC
Circle 1	12.06 sec	3.91 sec
Circle 2	10.32 sec	3.29 sec
Circle 3	9.97 sec	3.17 sec
Circle 4	9.92 sec	3.08 sec
Circle 5	4.12 sec	1.29 sec
Circle 6	10.48 sec	3.41 sec

Table 1. Comparison of speeds

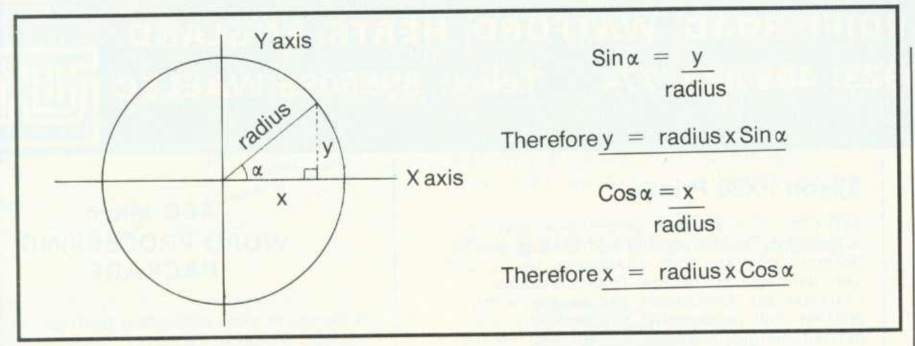


Figure 1.

The third method of programming circles uses polar co-ordinates. Listing 6 gives an example of a circle drawn using polar co-ordinates. These are not as difficult as might at first seem. Instead of there being 360 degrees in a full circle, there are 2*PI radians. The rest is standard trigonometry (figure 1).

Strings in store

AN ARRAY is an arrangement of items of data, each identified by a key or subscript. Mr Thompson of London has sent in a program that uses string arrays (that is, arrays which store letters or words rather than just numbers). The program works for so long and then comes up with a 'No room' error.

The problem is rather obscure and concerns the BBC's and Electron's method of storing string arrays. The way Mr Thompson's program has been designed it puts names into an array and occasionally changes them. When the names are changed for longer ones the program will sooner or later run out of room.

Unlike some computers – the Spectrum, for instance – the BBC and Electron don't need the length of each string variable in an array to be specified when the array is dimensioned. This means that when the string variables in an array are stored in memory, only the exact amount of room is allowed as it is stored. Then if the string is redefined and the new string is longer than the old one it has to be stored elsewhere in memory. The old space is just left unused.

If then there is little memory left at the end of a program, and the strings are subject to change in length, the computer can run out of memory because of the space wasted. This is demonstrated by listing 7.

The program defines an array 100 variables long, and then stores a one-character string in each variable. (Remember that the first string variable of the array is A$(0).) Then the program stores a two-character string in each variable – and so on until it runs out of memory. On the Electron or a disc-based BBC it runs out of memory when T=52, and on a cassette-based BBC when T=61. The difference is accounted for by the different modes each computer works in and the different amounts of memory then remaining.

The cure is easy. Decide on the maximum length of the longest string variable in the array and then define dummy strings to reserve that amount of space. Listing 8 shows how this can be done to save an array 100 variables long, each string variable having a maximum length of 20 characters. The dummy string in this case is a series of asterisks, but you could make them any character you like.



STEVE OSTLER of London was inspired by George Hill's series on printers to write a four-colour screen dump for the Seikosha GP-250X (listing 9). It takes 10-15 minutes to dump, but this could be speeded up by using more integer variables (see the item on drawing circles). Also the dump prints sideways and will not print the bottom two lines of the screen.

Mains spikes

I HAVE received an interesting letter from Chris Beesley of Cheadle, prompted by February's article on cassette loading. He has echoed many of my suggestions made in this column in the March issue and also suggests that the cassette be run off batteries to avoid recording clicks caused by mains spikes. These are frequently caused by electrical equipment switching on elsewhere. Appliances with powerful motors such as washing machines and fridges (as well as strip lights) are particularly prone to cause spikes – ever noticed the TV picture jump when one of these appliances is switched on? N A Hird has similarly found that programs can be corrupted by mains spikes.

There are two solutions other than resorting to batteries. One way is to record each program twice. Then if one block will not load, wind the tape on to the second copy and carry on loading from there. The Beeb will allow you to wind and rewind in the middle of a program and will carry on loading from the point at which it was interrupted. There is no need to load from the start of the program again.

The other way is to buy a special device called a mains transient suppressor. Maplin Electronic Supplies of Rayleigh, Essex, sells a small device for less than £1 that has a very high resistance at 240 volts, but the moment a spike appears on the supply line which exceeds the peak level of the mains voltage the impedance of the device drops immediately to a very low level, dissipating the unwanted energy. The device is so small that it can easily be wired across the live and neutral terminals of the cassette player mains plug.

It is wise to insulate each lead of the suppressor with plastic sleeving. Make sure the component is carefully fitted so that there is no risk of it or its leads being accessible from outside the plug or shorting to any other terminal. Mains voltages are dangerous and care is always needed. The appliance must be unplugged from the mains before starting.

In and out of ROMs

I WAS interested to read Joe's Jottings in *Acorn User* (March) about sideways ROMs (see also Beeb Forum). There can be problems where one ROM interferes with another. When two ROMs have common commands you should disable the offending ROM so that the command can be used with the other ROM. A ROM can be disabled by poking a particular memory location for that ROM. To disable a ROM in the sideways socket type

```
?&2A1+(ROM socket number)=0
```

where the ROM socket number is the number of the socket where the ROM is situated, and can take a value between 0 and 15. Zero is the left-hand ROM socket looking from the front of the computer, and 3 will be last.

To switch the ROM back in again type

```
?&2A1+(ROM socket number)=255
```

I expected to encounter a problem when I bought the new Basic II chip to replace my existing Basic I. I wanted to be able to switch between either version of Basic to test out programs on both. I was pleasantly surprised to find that both can reside in the sideways sockets without interfering with each other! The BBC treats them as different languages. I put the Basic II chip in the socket before Basic I so my machine will normally use the later version. When I wish to use Basic I I simply type

```
*FX142,(ROM socket number)
```

Similarly I can reselect Basic II again.



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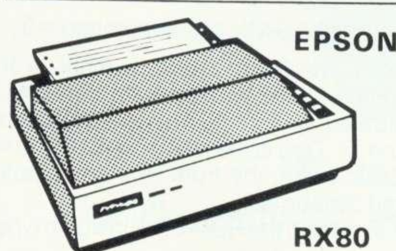
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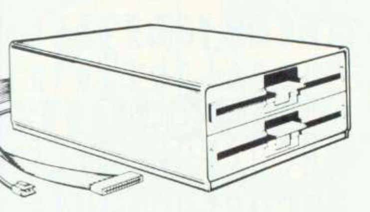
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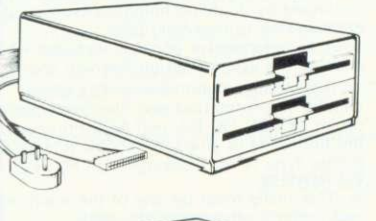
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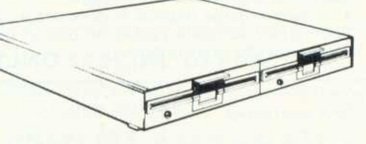
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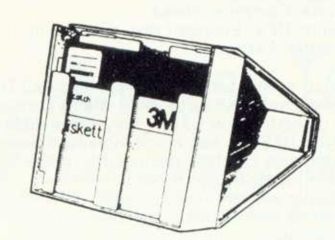
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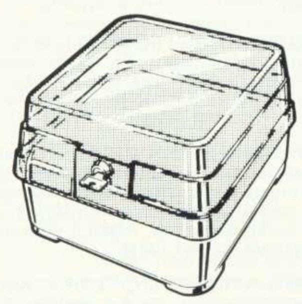
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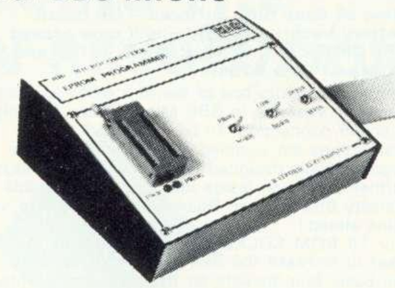
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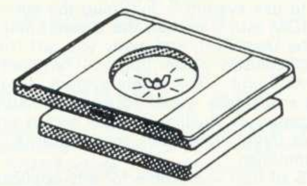
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Superior DFS; Excellent disc sector editor – *Computer Answers*

Without a doubt, the most sophisticated DFS Software yet written for BBC Micro Computer. This powerful new DFS is fully compatible with ACORN DFS yet has much increased power due to additions, carefully designed to make life easier in normal use. It consists of over 14K of efficiently written machine code. It is entirely self contained and so does not require a utilities disc to function.

● The system can either use the ACORN standard 31 files per disc side or DOUBLE THE CAPACITY to 62 files. The size is selected at formatting time. Copying between discs with different catalogue sizes works perfectly normally.

● A FORMATTING PROGRAM is built in, permitting formatting to 35, 40, 80 track formats with either 31 or 62 files. Since the formatter is built in to the DFS it can be used without affecting whatever program you are using.

● A DISC VERIFIER is also built in. This checks the internal checksums on each sector to identify any corrupted data. This is extremely useful when saving valuable data as it shows faulty discs quickly and easily. Again it does not affect the program you are using.

● A built in DISC SECTOR EDITOR gives a screen window onto the disc enabling detailed editing of any byte on the disc. This is very useful for recovering accidently deleted files and can save weeks of work.

● A double step mode allows the User of 80 TRACK DRIVES TO READ & WRITE BOTH 40 and 80 TRACK DISCS. This mode is software selected for each drive individually, thus enabling a 40 track disc to be copied on to an 80 track very easily. THIS ELIMINATES THE NEED FOR EXPENSIVE 40/80 TRACK SWITCHABLE DRIVES.

● A WORKFILE function sets the name to be used when the null filename is issued. This allows a program to be edited and repeatedly saved having only typed its name once.

● When using LOAD, CHAIN, etc, it is possible to specify an ambiguous filename. This will result in the first file whose name matches the specification being used. This saves typing the end of a filename that you know is uniquely identified by its first few characters.

● Two commands exist to simplify the transfer of programs from TAPE TO DISC. These load the file to &1100, switch off the disc system and then move the file to its correct load address; thus saving a lot of complicated programming. This command can be used to load files up to 27K75 long.

● An advanced COPY command is included which will prompt the user, requesting whether to copy each file.

● RENAME has been extended to allow the use of ambiguous filenames. This allows you to change BERT1, BERT2, BERT3 to FRED1, FRED2, FRED3 with only one command.

● OPENOUT has been improved to give you fewer annoying 'Can't extend' errors, as it automatically picks the biggest space on the disc in which to put a file. A SPACE command lets you know how much space *COMPACT could create before you waste time doing it.

Continued:

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Once fitted, the 16K ROM will enable you
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ABCDEFGHIJKLMN
ABCDEFGHIJKLMN
abcdefghijklmn
ABCDEFGHIJKLMN
ABCDEFGHIJKLMN
abcdefghijklmn
ABCDEFGHIJKLMN
ABCDEFGHIJKLMN
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ABCDEFGHIJKLMN
ABCDEFGHIJKLMN

★ **It works in modes 0, 1, 2, 4, using f colour.**
★ Simply use Ctrl–V to select the font and further screen output will be in a new style.
★ Even the ordinary Beeb character set ca enhanced by doubling height or width and emphasising to give bold print.
★ A comprehensive editor is included whic enables the user to design his own characte
★ A spooling program is provided, which enables pre-formatted text files to be displa on an EPSON FX, RX, and NEC Printers, us the full range of character styles. (Please sp printer type when ordering). Can be used w WORDWISE.
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★ A twenty page manual is provided and t demo/editor software comes on disc or cass (please specify when ordering). **ONLY**

DFS continued:

● 2K of RAM can be reclaimed from the D by setting "PAGE" to & 1100.

Now with extra features:

● The powerful library system has been extended so that libraries now work on all accesses not only *RUN. This allows you to a utility directory with all your commonly us programs without muddling in your current workfiles. Very useful for BCPL User.

● Programs can now reside lower in memo reclaiming some of the DFS' workspaces, in PAGE can be taken as low as £1100 under circumstances.

● To make DFS easy to use, wild cards ("* have been made vastly powerful, e.g. *INFO gives information on all files in the current directory which have an "A" anywhere at al their filename.

● Comprehensive and clearly written Manu (available separately) gives the user a compl package deal.

● Fully compatible with BBC TELETEX and TORCH Systems.

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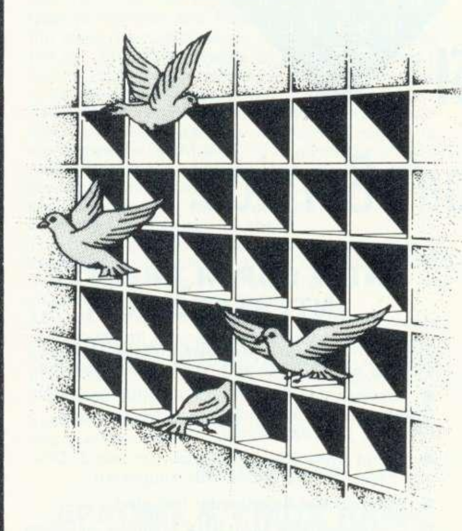
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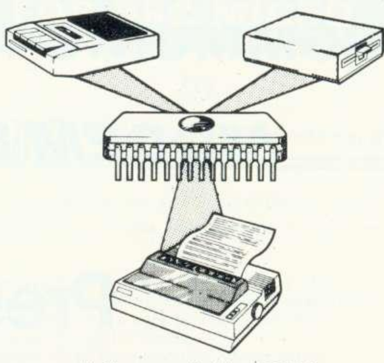
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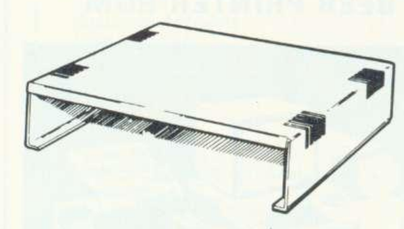
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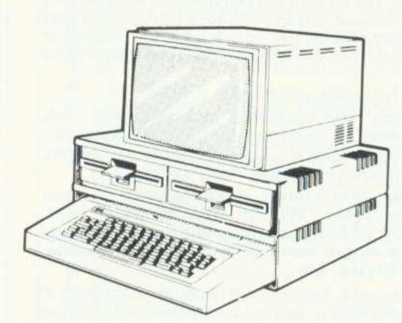
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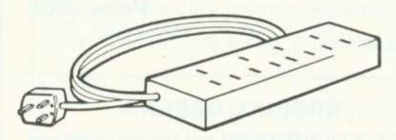
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BALANCING ACT

Stan Froco returns to the theme of binary trees*. Their balanced structure makes 'B-trees' valuable for databases stored on disc

* See August 1983 issue

FIRST a quick reminder of what a 'tree' is. Figure 1 shows a simple binary tree of numbers. At the top is the 'root' of the tree. The tree comprises 'nodes', each holding a value and two 'pointers'. At the bottom of the tree are its 'leaves', which are like nodes, but have no pointers. In the example the root is labelled A, the nodes B and the leaves C. Notice that the root is just another node.

The pointers are the arrows joining the parts of the tree. We say a node has two pointers to its 'children' (which may be other nodes, or leaves), and correspondingly the children have the node as their 'parent'. The root is unique in that it has no parent.

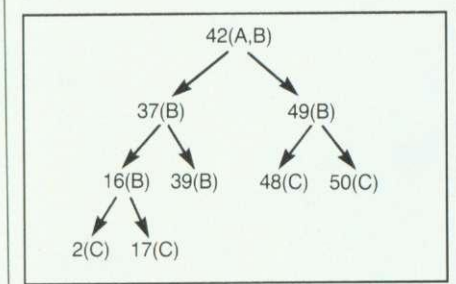


Figure 1. A simple binary tree

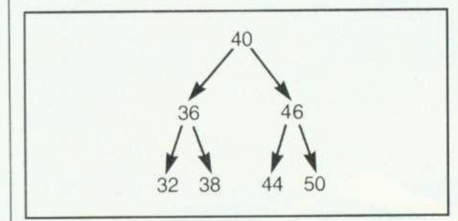


Figure 2. A tailor's database

Trees are useful for looking up information and as such form the heart of many database systems. The pieces of information held in the nodes and leaves of the tree are referred to as 'keys'. We talk of looking up a key in a database. Figure 2 shows an example application, a database of jacket sizes stocked by a tailor. If he has a jacket of the correct size it appears in the tree. The method or algorithm for looking up an item in the tree is fairly straightforward:

1. Take the root as the first node to examine.
2. If the item matches the key for this node STOP – we have found the item in the database.
3. If the node has no pointers, ie, it is a leaf STOP – the item is not in the database.
4. If the item is less than the key for this node, take the node or leaf pointed to by the left pointer, ELSE take the node or leaf pointed to by the right pointer.
5. GOTO 2

In other words we walk down the tree looking for the relevant key. Typically, we would store additional information with the key – for instance, the number of jackets in stock in this example. The key is crucial, however, since it is the thing we are comparing against.

For database applications a simple binary tree is not flexible enough. You will see that while looking up an item the number of steps taken is up to the number of steps taken to get to a leaf from the root. In Figure 1 you will see that the distance from root to leaf varies depending on the leaf. Figure 2 is, on the other hand, a 'balanced binary tree'. Every leaf is the same distance from the root (this distance is called the depth of the tree, in this case three). If a tree is balanced we know the worst-case performance (ie, the number of steps it takes to find a particular key) is as small as possible.

This is not that important when the tree is small and in memory, since following a pointer to another place in memory is not that slow an operation. However, for a large database the tree will be held on disc or some other backing medium. Following a pointer now means getting another block from disc, and is very slow. For this reason we want trees as near balanced as possible to minimise disc access. Binary trees are tricky to balance, and so we need to look at some more sophisticated types of tree.

One way of extending binary trees is to have more than two children for each node (possibly a variable number). This means that it spreads out faster and for a given number of nodes is not so deep, requiring fewer steps to look up a key. 'B-trees' are a popular example of such trees. A 'B-tree of order m' has five properties:–

1. Every node has m or fewer children.
2. Every node that is not a leaf or the root has m/2 children or more.
3. The root has at least 2 children (unless it is a leaf).
4. All leaves are at the same depth and contain no information.
5. A non-leaf node with k children has k-1 keys.

Figure 3 shows a B-tree of order 5. The general form of each node is

p_0	k_1	p_1	k_2	p_2	k_3	p_3	k_4	p_4

We can see that each key is less than any key in the tree pointed to by the corresponding pointer, ie:

$k_4 <=$ any key pointed to by p_4
$k_3 <=$ any key pointed to by p_3
$k_2 <=$ any key pointed to by p_2
$k_1 <=$ any key pointed to by p_1

Finally p_0 points to all the keys less than k_1.

To be of any use in a database we need to provide the three operations

1. Look up a key in the database.
2. Insert a key in the database.
3. Delete a key from the database.

Program 1 uses a B-tree of order 7 and provides lookup (PROCretrieve) and insertion (PROCaddtotree). For conciseness I have left out deletion, since this is essentially the technique for insertion in reverse. Given one, you should be able to deduce how to do the other. page 49 ▶

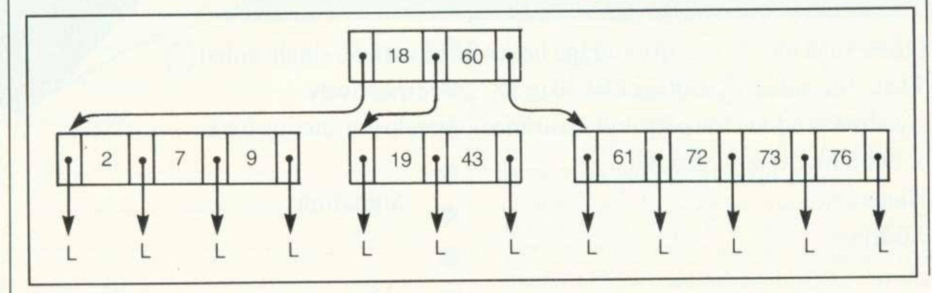


Figure 3. A B-tree of order 5

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Program 1. Demonstration of B-trees, using a B-tree of order 7

```
10 REM***********************************************************
20 REM
30 REM      Demonstrate operations on B-trees
40 REM
50 REM***********************************************************
60
70 MODE 7
80
90 REM Useful values
100
110 limstore% = 1000
120 infinity% = 1000000
130 leaf% = -1 :REM pointer to a leaf
140 nextfree% = 0 :REM where to start dishing out store from
150
160 REM Set up some arrays
170
180 DIM tree%(limstore%)
190 DIM temp%(14) :REM workspace
200 root% = FNgetnode :REM the root of the tree
210
220 PRINT "Enter some sample data, ending with 0"
230
240 REPEAT
250    INPUT ":" data%
260    IF data% = 0 THEN UNTIL TRUE : GOTO 310
270    PROCaddtotree(data%)
280    UNTIL FALSE
281
290 REM Try retrieving
300
310 PRINT "Try some lookups"
320
330 REPEAT
340    INPUT ":" data%
350    PROCretrieve(data%,root%)
360    UNTIL FALSE
370 END
380
390 REM****    Return a new node for the tree
400
410 DEF FNgetnode
420    LOCAL t%
430
440    t% = nextfree%
450    nextfree% = nextfree% + 13
460
470    IF nextfree% > limstore% THEN PRINT "Store used up" : STOP
480
490    FOR i% = 1 TO 11 STEP 2
500       tree%(t% + i%) = infinity%
510       tree%(t% + i% + 1) = leaf%
520       NEXT i%
530
540    tree%(t%) = leaf%
550
560    =t% :REM the new node
570
580 REM*****    Add a new data element
590
600 DEF PROCaddtotree(key%)
610    LOCAL newroot%
620
630    IF FNinsert(key%,root%) THEN ENDPROC :REM successful insertion
640
650    REM Create new root
660
670    newroot% = FNgetnode
680    tree%(newroot%) = root%
690    tree%(newroot% + 1) = reskey%
700    tree%(newroot% + 2) = respt r%
710    root% = newroot%
720
730    ENDPROC
740
750 REM****    Insert new element in a subtree - TRUE => inserted
760
770 DEF FNinsert(key%,node%)
780    IF tree%(node%) = leaf% THEN =FNdoinsert(key%,leaf%,node%)
       :REM at bottom
790    IF FNinsert(key%,tree%(node%+FNfindplace(key%,node%)))
       THEN =TRUE
800
810    REM Must have to split
820
830    =FNdoinsert(reskey%, resptr%, node%)
840
850 REM****    Find where to insert in node
860
870 DEF FNfindplace(key%,node%)
880    LOCAL i%
890
900    IF key% < tree%(node% + 1) THEN =0 :REM at beginning
910
920    i% = 11 :REM linear search through (from highest)
930
940    IF key% >= tree%(node% + i%) THEN =i% + 1
950    i% = i% - 2
960    GOTO 940
970
980 REM****    Insert a key
990
1000 DEF FNdoinsert(key%,keyptr%,node%)
1010    IF tree%(node% + 11) = infinity% THEN PROCinsertit(key%,keyptr%,node%) : =TRUE
1020
1030    REM No room in current node so split
1040
1050    PROCsplittree(key%,keyptr%,node%) : =FALSE
1060
1070 REM****    Insert in current node
1080
1090 DEF PROCinsertit(key%,keyptr%,node%)
1100    LOCAL i%
1110
1120    i% = 12
1130
1140    REPEAT
1150    IF key% >= tree%(node% + i% - 3) THEN tree%(node% + i% - 1) =
        key% : tree%(node% + i%) = keyptr% : UNTIL TRUE : ENDPROC
1160
1170    tree%(node% + i% - 1) = tree%(node% + i% - 3) :REM copy down
1180    tree%(node% + i%) = tree%(node% + i% - 2)
1190    i% = i% - 2
1200    UNTIL i% < 4
1210
1220    tree%(node% + 1) = key% :REM insert at the end
1230    tree%(node% + 2) = keyptr%
1240
1250    ENDPROC
1260
1270 REM****    Split the tree
1280
1290 DEF PROCsplittree(key%,keyptr%,node%)
1300    LOCAL i%
1310
1320    REM Copy to temporary node
1330
1340    FOR i% = 0 TO 12
1350       temp%(i%) = tree%(node% + i%)
1360       NEXT i%
1370
1380    REM insert key
1390
1400    i% = 14
1410
1420    REPEAT
1430       IF key% >= temp%(i% - 3) THEN temp%(i% - 1) = key% :
           temp%(i%) = keyptr% : UNTIL TRUE : GOTO 1530
1440
1450       temp%(i% - 1) = temp%(i% - 3)
1460       temp%(i%) = temp%(i% - 2)
1470       i% = i% - 2
1480
1490       UNTIL i% < 4
1500
1510    REM Now split it
1520
1530    resptr% = FNgetnode :REM the new tree
1540    reskey% = temp%(7) :REM the data to pass back
1550
1560    FOR i% = 0 TO 6
1570       tree%(resptr% + i%) = temp%(i% + 8)
1580       tree%(node% + i%) = temp%(i%)
1590       NEXT i%
1600
1610    FOR i% = 7 TO 11 STEP 2 :REM Clear the unused bit
1620       tree%(node% + i%) = infinity%
1630       tree%(node% + i% + 1) = leaf%
1640       NEXT i%
1650
1660    ENDPROC
1670
1680 REM****    The retrieval routine
1690
1700 DEF PROCretrieve(key%,node%)
1710    IF node% = leaf% THEN PRINT "Key not found" : ENDPROC
1720
1730    place% = FNfindplace(key%,node%) :REM find where the
        key is
1740    IF place% = 0 THEN GOTO 1770 :REM avoid trouble
1750    IF tree%(node% + place% - 1) = key% THEN
        PRINT "Key found" : ENDPROC
1760
1770    PROCretrieve(key%,tree%(node% + place%)) :REM recurse
        down
1780
1790    ENDPROC
```

I represent nodes as 13 element subdivisions of a large array tree%. Thus we have nodes consisting of elements 0-12, 13-25, 26-38 and so on. Every time I need a new node I use FNgetnode to tell which element in tree% to start with. Pointers to nodes are represented as the element of tree% with which that node starts. Thus a pointer to the node starting at element 26 is represented by the value 26.

Within each node we have alternating pointers and keys. For the node starting with element 13 of tree%, p_0 would be tree% (13), k_1 would be tree% (14), p_1 would be tree% (15) and so on up to p_6 at

page 53 ►

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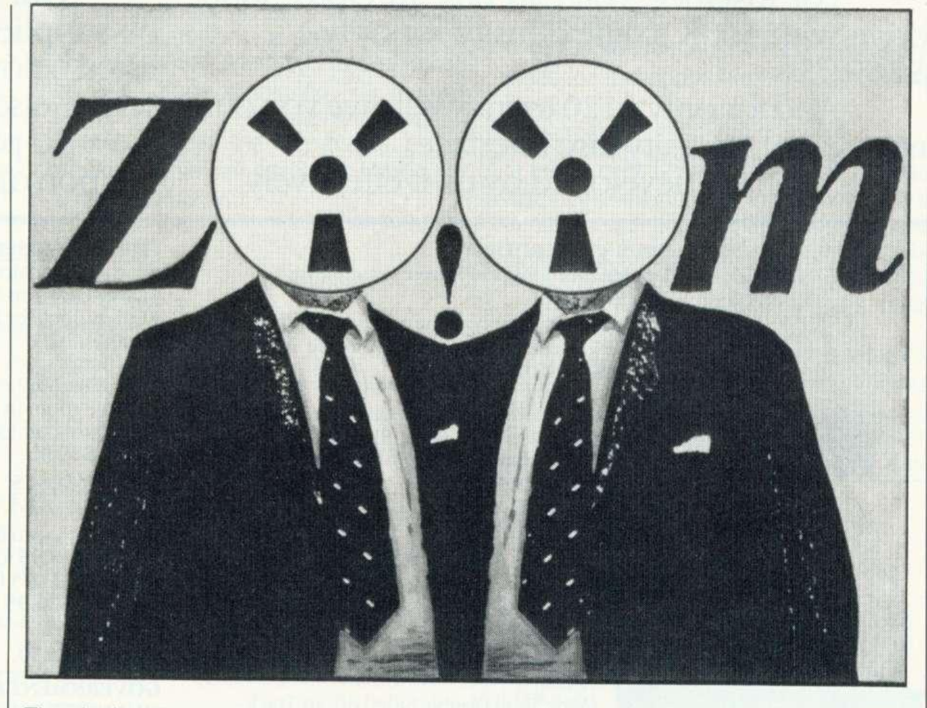
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FORTH DIMENSION

Paul Garfield talks the lingo



FORTH is a language developed in the early 1970s as a control language for machines. It is a compiled language and therefore it is fast, its speed being close to that of machine code, although its vocabulary can be quickly learned. It deals in integer maths only, and does not handle strings as Basic does, but where commands do not exist it is possible to create new command words with your own definitions – something that is not possible in other languages.

Its interactive compiler allows very fast development work on complex projects (examples of which are given later). Its only drawback is perhaps its use of Reverse Polish Notation (RPN) in arithmetical representation and a 'stack' system for mathematical work. The programmer has to put the maths into RPN before the computer can work on it, so that computer processing time is not wasted in calculations.

The conventional infix notation yields an expression of the following type:

3 + 4 =

In Forth this would be dealt with as follows:

34 +

which would be processed as follows:

Place 3 on the computer's arithmetic stack, place 4 on top of that (it is best to think of the stack as a pile of plates that you can add to), perform an ADD operation and place the result back on the top of the stack. The 3 and 4 will have gone, and a 7 will be found there if the computer is told to print out the value on the top of the stack.

A word could be developed that might be used in a calculator-style application with the word ADD. This is done with a colon (:) definition:

: ADD + . ;

This would take two numbers from the stack, add them and then print the result. That is the effect of the full stop (.). The semi-colon (;) must end all colon definitions. The user would now just type:

7 8 ADD <RETURN>

and the machine replies '15 ok'.

Now that we have seen an application that can be used, let's look more closely into the language.

First, Forth can be implemented in several ways. I have tried tape, disc and ROM. The first two are available from Acornsoft and Level 9 Computing, the ROM version from HCCS. As with any language that you load into RAM, you loose some of the mode calls – typically you cannot go below mode 4. The ROM gives you all the space and very fast graphics as well.

The programs in the article have been run on all the systems, this having been made possible by the uniformity imposed by the Forth Interest Group (Fig). There are two main types of Forth in use, Fig-Forth and Forth-79. The differences are small, as all the main words are clearly defined. I have even written in Acorn Forth and sent the ASCII source code to another computer for compiling and running, having tested it on a BBC. Try doing that with some other languages!

The general differences in the dialects appear to derive from the way different systems use their editor. Extra words are available, of course, to use functions such as VDU commands, but these are not really necessary, for it is not difficult to add your own words when, say, you want a graphics application. This saves filling memory with unwanted commands.

Let's look at some of the most important words. There are a number of stack operations, all of which can be tried out as soon as the language is loaded. Remember that a comment like '.' is used to represent a common word (you don't need the quotes).

Typing 2 3 will put those numbers onto the stack. 'DUP' then '...' will give 3 3 2. You made a copy of 3. Now the stack is empty, try another print. Notice the order. It is a LIFO stack, meaning 'last in, first out'.

To make a copy of the second item on the stack:

3 4 'OVER' '...'

This is useful when doing the following: a∗(a+b). Conventionally Forth programmers write a 'stack picture' if they want to sort out what is going on, so we

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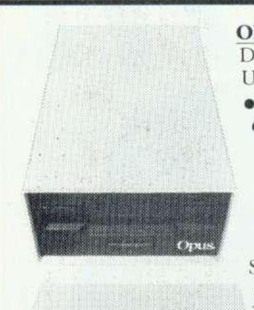
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can work out the procedure as follows:

```
        a b on the stack
OVER    a b a
+       a b+a
*       a*(b+a)
```

This can be tested in direct mode. Now write a new word – any name up to 31 letters. Always begin with a colon and end with a semi-colon:

: formula OVER + * .;

To use it just put the values on the stack using the 3 4 formula and out pops the answer.

The Forth application from Level 9 includes a good version of Logo and good editor facilities. The Acornsoft and HCCS editors are line editors. If you are going to write a number of words to make up an application it is nice to keep the source code, which is done by means of the editor. A 'screen' is built up at a time consisting of just 1024 bytes (16 lines of 64 characters). Each new word can be tested before the next is written, thus greatly reducing debugging time. Then the word is entered into the current screen, saved and called back and compiled. Comments can be included in each screen by means of brackets, as can be seen in the example below. Several screens can be linked together, and machine code routines can be built in if needed.

Listing 1 is a less trivial application that shows the power of Forth. It examines the memory, starting at a point in memory, looks at the next n location and prints out the ASCII code alongside – a memory dump, in fact. The screen lines are numbered and the comments are in brackets. Note the ease with which you can change base.

Listing 1. A memory dump in Forth

```
1HEX ( select HEXadecimal )

2 3000 CONSTANT NO 8 NO C! ( a memory location called NO with 8 stored  in
it )

3 3001 CONSTANT buff ( a memory location called buff where 8 bytes will be
stored)

4 : J RP@ 7 + @ ;  ( define a second loop counter J  )

5 : LETOUT buff NO @ TYPE ;
( The main VERB is DUMP )

6 : DUMP  CR OVER DUP ROT + SWAP DO
(  Inner  LOOP  I 8 BYTES adding I and J gives real ADDRess C@ FETCHES the
value, make a DUPlicate PRINT it in 3 columns justified from the Right )

7  8 0 DO I J + C@ DUP 3 .R
( DUPlicate it again AND test for the limit 20 HEX to 7A HEX )

8  DUP DUP 20 > SWAP 7A < AND IF
( IF it is store it in our buffER Index by I ELSE forget it DROP and put a
DOT  2E instead )
9   I buff + C! ELSE DROP 2E
10   I buff + C! THEN LOOP
( DO all 8 times then goto LETOUT to TYPE the 8 ASCII characters )
11   2 SPACES LETOUT
( Carriage Return on a new line and jump 8 in the J LOOP )
12  CR 8 +LOOP DROP ;
```

With two numbers on the stack, first the starting address then the number of bytes, use the program as follows:

8000 50 DUMP <RETURN>

lists 50 hexadecimal bytes from 8000 HEX onwards.

The stack moves like this:–

ADDR N DUMP
N ADDR OVER
N ADDR ADDR DUP (DUPlicate)
ADDR ADDR N ROT (ROTate 3rd item to top of STACK)
ADDR ADDR + N +
ADDR + N ADDR SWAP (This gives our limits for the count like a FOR ... NEXT loop)

This looks a lot with all the comments, but in fact is only 12 lines altogether. Loaded and compiled into memory, it takes only a small number of bytes. Notice that the job is easy to break down into simple sub-jobs, each of which can be coded individually. Once LETOUT has been defined, it can be tested.

Line 4 is needed only on the HCCS version as there is no J loop counter, but that is not a real problem. Most books on Forth say that if you are nesting more than twice you should be doing it another way!

FURTHER READING

'Starting Forth' by Leo Brodie (Prentice-Hall)
'Forth on the BBC Micro' by R de Grandis-Harrison (Acornsoft)
'Welcome Forth' by J W Brown (HCCS)
'The Complete Forth' by Alan Winfield (Sigma Technical Press)
'Forth Programming' by Leo Scanlon (Blacksburg)

B-TREES

◀ *page 49*

tree% (25). Since leaves hold no information they can be represented by a special pointer value, not used elsewhere, leaf%. FNgetnode initialises the new node with leaf% in all its pointers, and a number larger than any possible key, infinity% for all its keys.

The algorithm for lookup is similar to that for a binary tree. To find an item x:

1. Take the root as the first node.
2. Starting with the largest key, and working down, find the first key so that key < = x.
3. If there is no such key take the node pointed to by p_0. If this is a leaf STOP – key not found, ELSE GOTO 2
4. If the key = x then STOP – key found, ELSE take the node pointed to by the corresponding pointer (eg, if the key is k_1 take p_1).
5. If this is a leaf STOP – key not found ELSE GOTO 2

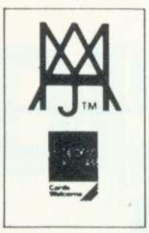
The function FNfindplace is used to do stage 2.

Insertion is rather more complex. We use a similar lookup method to find where in the bottom level of the tree to put the new item (FNinsert and FNdoinsert). If there is room in this node we use PROCinsertit to add the new item and return TRUE to indicate successful insertion. Otherwise, we call PROCsplitit to split the node in two. We get a new node.

In the old node we leave p_0 and the three smallest keys and their associated pointers. In the new node we put the three largest keys and their pointers as the bottom three keys and pointers. This leaves a key and a pointer. The pointer becomes p_0 of the new node. The new node is put in resptr% and the remaining key in reskey%. These then must be inserted into the parent node as a new key pointer pair on return. FNdoinsert duly returns FALSE to indicate that this must be done to FNinsert. The whole process then repeats recursively.

B-trees are particularly valuable for databases stored on disc. In this case the nodes become blocks on the disc and pointers are the position of the block on the disc. Nodes can be much larger to take advantage of the size of a block (256 bytes on the Beeb DFS), and since they are always guaranteed to be at least half full they make efficient use of the space. Finally since the tree is always balanced, we know that the worst-case time for lookup is minimised.

If you wish to implement a database using B-trees you'll need additional information. Implementation details are well covered in *Data Structures and Algorithms* by Aho, Hopcroft and Ullman (Addison-Wesley, 1983). The use of B-trees for databases is explained clearly in *An Introduction to Database Systems* by C J Date, third edition (Addison-Wesley).



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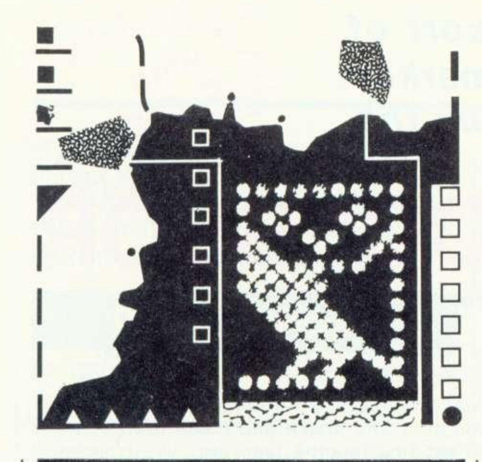
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4. List all breakpoints.
5. Remove a breakpoint.
6. Display memory.
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8. Find a stipulated string.
9. Find a stipulated byte.
10. Execute a jump to a specified address.
11. Disassemble a stipulated section of memory.
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George Hill, your host this month, takes up the tape-to-disc challenge – plus random numbers, error reporting, Assembler quirks

Transfer to disc

IN THE December Beeb Forum Ian Birnbaum suggested someone should adapt his one-line tape-to-disc transfer routine to cope with all sorts of programs.

The process isn't simple, and the only way to get all types of program loaded and saved is to use a *LOAD command at a fixed address, followed by a *SAVE from the same fixed address. The *SAVE command requires the program length.

The result of this *SAVE will be to deposit the correct information on to the disc in the *program* but will leave the file information (read by *INFO) in a useless state. It will contain the same fixed address for all files, and the file-length, but no record of load and execution addresses.

Users of machine code may have met similar trouble already. Suppose you have written an assembly language program which assembles the code correctly and is position-independent, but occupies the space in which you need to assemble the code. What I have done in the past is to save the assembler program, alter PAGE, re-load the program out of the way, reassemble, and save the code.

OSFILE can help avoid all this. OSFILE is an operating system routine, called via &FFDD, which carries out tape and disc housekeeping activities. A short article in the October 1983 issue (page 66) showed how OSFILE can load and merge programs and tell if a file exists. It can also be used to change the file information for an existing file on a disc, including the modification of the name and the various addresses without touching the file contents. *RENAME uses the routine.

The transfer programs work as follows.

Program 3 is a loader program (see yellow page iii) which contains at line 0 the 'auto-run' routine by A Oliver (Forum, October, page 52). It then shifts PAGE down to the minimum value under which the disc filing system will operate (thanks to Joe Telford for this). It then chains the main program which carries out the transfer.

Program 4 is the business program and uses mode 7 to give access to as much memory as possible. As the program is now located at &1100, HIMEM can be set to &1900, restricting the working area of the loading and saving program and freeing the whole memory from &1900 to &7BFF as a 'buffer' for programs, files and so on. OSFILE is defined, and space for the program name and the required control_block for OSFILE to work in are reserved by the DIMs. The first two bytes of the control_block are now made to 'point to' the name. X% and Y% are similarly made to point to the control_block, in preparation for the CALL to OSFILE.

Now TAPE is selected, and the options set to give full messages (*OPT1,2) and to abort if a read error occurs (*OPT2,2). This latter may not be what you want, in which case omit it. The screen is now cleared and set up so that the Birnbaum screen reading method can be used. This finds the program's name, its length, its load address and execution address. These are extracted from the screen memory in PROCsave_file. The next file on the tape is loaded in at address &1900.

The filing system is switched to disc, and the values of A$, B$, C$ and D$ are made equal to the strings on the screen at the end of the *LOAD operation with *OPT1,2 on. These are, for example:

```
SCREENTEST 01 0105     FFFF0E00 FFFF801F
<  name   >    <ln>    < load > < exec >
    A$          B$        C$       D$
```

for the Basic program Screentest. The information appears on line 5 of the screen, which starts at memory address &7CC8 (HIMEM + 100).

The name presents a problem as some tapes (eg, the Forth language tape) contain four or five programs with the same name. The transfer program as it stands will simply overwrite each identically-named program with the succeeding one. This can be got round by fiddling the names. One other suggestion would be to have a 'rolling' directory letter added to each program as it loads, so the first is A.FORTH, the second B.FORTH, etc. The transfer program reads only the first nine letters of the name (I% = 0 to 8 at line 300); and cuts out the last two, unless there is a full stop (indicating a directory letter) at position 2 (line 320).

Whatever you do, you must ensure that the final name is either:

< one letter > . < seven letters >

or

< seven letters >

otherwise there will be a fatal error. The space reserved for the name is now poked ($name = ...) with the name, followed by a carriage return (CHR$13).

The control_block is now emptied and re-set so bytes 10 to 13 contain the start address for the *SAVE, and bytes 14 to 17 the end address. The end address is the start address (&1900) plus the value of B$ in hex, calculated using EVAL ("&" + B$). A% and byte 6 of control_block are both set to 0 for a *SAVE command, and OSFILE is called.

To adjust the addresses, a further call to OSFILE is required. A% is set to 1, and the load and execution addresses and the length are plinged (!) into the required places in the control block (bytes 2 to 5, 6 to 9, and 10 to 13, respectively). Byte 14 is set to 0, giving 'open access' files. If you want to produce 'locked' files line 540 would be

540 control_block!&E = 2

See the article 'Protection racket' in February's issue for a simple routine to deal with locked files.

The following ideas could be used to develop the routine. First, note that the OS keeps a copy of the current filename and file information when loading from tape. This is located in page 3 at addresses as follows:

&3B2 to &3BD – Filename (terminated by 0)
&3BE to &3C1 – Load address
&3C2 to &3C5 – Execution address
&3C8 to &3C9 – Length of file (note only two bytes).

These can be used as an alternative method of obtaining the file information, replacing the Birnbaum screen read.

Next the method of causing the changing of PAGE to &1100 for the running of the program has been superseded by STARRUN in the March issue.

Third the whole process can be accomplished via OSCLI using the fourth (undocumented) parameter, which is the RELOAD address for a file.

The disc copies produced will be exact copies of the files on the tape. They will not

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necessarily run in the form in which they appear, though you will be able to LOAD, *LOAD or *EXEC them. Details of the pitfalls and tricks of tape-to-disc adaptation would occupy another article.

'Perfectly random'

IN DECEMBER'S issue, John O'Brien asked for a way to obtain a 'perfect' sequence of random numbers where no number duplicates itself. Philip Blythe of Aylesbury has provided just such a routine for the Electron and BBC micro, which is given as program 5.

Program 5. 'Perfect' random number routine by Philip Blythe

```
 10 MODE 7
 20 DIM X(10)
 30 A=1
 40 REPEAT
 50   T=RND(10):Q=1
 60   IF X(Q)=T THEN
      50
 70   Q=Q+1
 80   IF Q<10 THEN 60
 90   X(A)=T:A=A+1
100   UNTIL A>10
110 PRINT"Perfect
      random numbers"''
120 FOR P=1 TO 10
130 PRINT X(P)
140 NEXT
```

Wrong messages

A PROCEDURE from Andrew Woods of Fruitgum Software(!) allows a user to create error conditions in a program so the error message (errors$) will be printed by REPORT and the error code (error%) by PRINT ERR.

The routine (program 6) may be placed anywhere in RAM, except zero page, by altering the value of e% in line 1010. Line 1060 may be omitted and placed anywhere in the program so that once the procedure has been run once, it may be called from any part of the program. Similarly, other messages may be placed in RAM and called as needed.

For example:

10 IF A% < 0 PROCerror (100, "You entered a negative number")

will produce:

You entered a negative number

when REPORT is entered.

The value of error% may be trapped in an ON ERROR routine:

100 IF ERR = 100 GOTO ...

The routine will work on the Electron and BBC micro.

Program 6. Procedure to alter error handling by Andrew Woods

```
1000 DEFPROCerror(error%,error$)
1010 e%=&2F00
1020 ?e%=0 : REM 0 is BRK in machine code
1030 e%?1=error% : REM value for ERR
1040 e%$2=error$ : REM message for REPORT
1050 e%?LEN(e%$2)=0
1060 CALL e%
1070 ENDPROC
```

ROM in command

HERE is a tip for all those BBC micro users who have several paged ROMs installed, and have found that two or more ROMs recognise the same command. The function key definitions in program 7 will allow selective disabling of any ROM so that all the commands provided by the disabled ROM effectively no longer exist and any commands which were duplicated in other ROMs may now be used (OS 1.2).

Key f1: Disable a particular ROM by its number.

Key f2: Re-enables a disabled ROM, again by number.

Key f3: Gives a list of the current ROM types.

When using f1 and f2 the system asks for the ROM to be dis/enabled. This should be entered as a number in the range 0 to 15 where the number is the actual device number of the ROM to be acted upon. In the Beeb, the four paged ROM sockets are numbered 12 to 15 reading from west to east with the keyboard facing towards you.

If any ROM expansion boards are fitted, the manufacturer's data should be consulted for the ROM numbers.

Mark Clegg from Rossendale provided this tip.

Program 7. Function key definitions prevent sideways ROMs interacting. By Mark Clegg

```
   10 *KEYOCLS:I."Disab.e Rom-"I%:J%=I%+
&2A1:?(&70+I%)=?J%:?J%=0|M
   20*KEY1CLS:I."Enable Rom-"I%:J%=I%+&2
A1:?J%=?(&70+I%)|M
   30*KEY2CLS:@%=3:P."Rom types-"'':F.I%
=&2A1TO&2B0:P."ROM",I%-&2A1,"IS TYPE"~?I
%:N.:P.''|M
```

Assembler quirks

MR SHILL from London has pointed out a difference in the way Basic and the Assembler in the BBC micro and Electron handle expressions containing illegal hex values. When confronted with:

PRINT &2OE (that's O not zero)

Basic returns the error message 'no such variable'. The O and all the following characters are ignored.

However, the Assembler acts differently. The expressions:

LDA #&2OE or LDA &2OE

are assembled as

LDA #&02 or LDA &02

repectively, but no error message is generated, even if OPT 3 has been selected!

The reason for this lies in the routine the Assembler uses to evaluate the hexidecimal number, which is so written that it exits when it meets the first non-hex character. Therefore, the ASCII hex to binary conversion routine within exits on meeting the O – after the 2 has been correctly evaluated and is subsequently assembled as the operand.

Another quirk of the way this conversion routine works is that if more than two bytes are expressed as an operand address it is the last top bytes that are assembled, any preceding bytes are dropped. Thus the line

LDA &CAFE9

would be assembled as:

AD E9 AF LDA &CAFE9

the address assembled as the operand being &AFE9.

The subject of Os and 0s throws up an interesting challenge. It would be useful if the Beeb could be made to interpret O as 0 if it was obviously being used to form a number, be it hex or decimal. Can anyone provide a routine that will allow this? £10 awaits the best solution which is transparent to the user.

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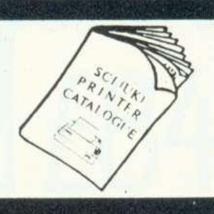


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LEADER OF THE PACK

Alan Samuels deals a useful hand of routines for brighter play

THE most alluring aspect of any game is usually the graphics. Even the most uninteresting program can be enhanced by putting pictures on the screen. Take a card game, for instance – Pontoon, Whist, Patience – where the images are an essential ingredient. The first step is to produce a blank card that may be printed in any colour at any position on the screen.

There are two ways of doing this. First the card may be produced by means of filling in two adjacent triangles with the PLOT 85 command as follows (see also full program, listing 1, yellow page iv):

Part 1
To produce the card, type:

MODE 1 then PROC_draw_card(A,B,C)

where A is the horizontal position across the screen on which the bottom right hand corner of the card should be situated and B its vertical position up the screen (figure 1). C is the colour that it is to be printed in (figure 2). For example:

PROC_draw_card(540,360,3)

will print a card in the centre of the screen in white.

This is done by moving the graphics cursor, first to point 1 in figure 3, then to point 2. Issuing a PLOT 85 command moves it to point 3 and colours in triangle A. The cursor is moved to point 4 and another PLOT 85 command issued, and it then moves to point 5 – the starting point – and produces the adjacent triangle B. Line 1010 defines the colour to be first.

Part 2
Another way to produce a rectangle is to define a graphics window and colour it in as follows: line 1040 is added to 'break' the graphics window once it is no longer needed. It is always good practice to do this as a graphics window accidentally left prevents the display of graphics on any other part of the screen.

As in the other method, the card is produced with the line

PROC_draw_card(540,360,3)

Now you have a method of drawing a card (you may use either method 1 or 2) the next stage is to produce the card through a program. The x_coord and y_coord numbers can be stored in data lines and called as in part 3, for example.

Part 3
Now to producing an emblem for the back of the cards. As this is written for the BBC computer (there is no reason why it should not work on an Electron) I decided to use the BBC owl logo.

To do this you use the user-definable characters of the BBC. The first step to produce a character is to draw it as a series of dots on an 8 x 8 matrix. As the owl takes up more than one 8 x 8 matrix you will use a series of characters placed together (figure 4).

Every computer character – eg A, 1, z, ? – has a unique code. The code for A is 65, so to produce this letter you could type PRINT CHR$(65). The codes from 224 to 255 are left blank and by using the VDU command you can define them to be any shape or character you like on an 8 x 8 matrix.

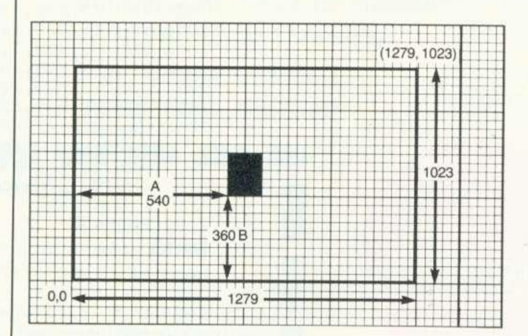
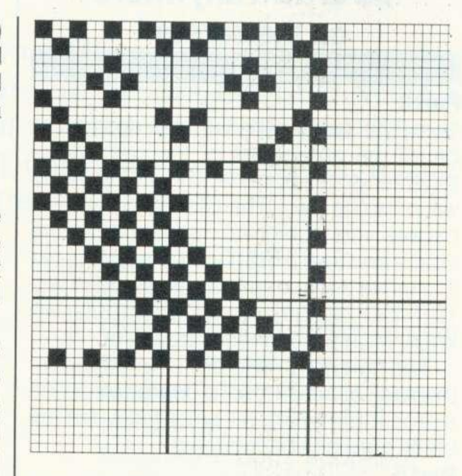


Figure 1. Position the card on the screen

To convert the shape into something the computer will understand, add up the dots as follows (figure 5): start with the 0. If the first square on the right of the first horizontal line is shaded, add 1. If the second is shaded add 2 and so on, doubling the number to be added each time. Follow this process for each horizontal line. For example, with the first line of the first character of the owl the second, fourth, sixth and eighth squares are shaded so add:


Figure 4. The owl is made up of a group of defined characters

0 + 2 + 8 + 32 + 128 = 170

Now we have to allot these numbers to a character code which may be any number from 224 to 255. Taking 224 as an example, the command would be:

VDU 23,224,170,65,136,20,136,65,160,80

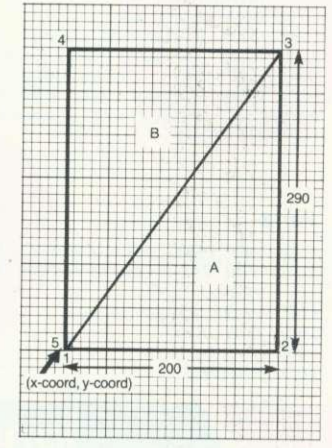


Figure 3. Drawing the card by cursor control

Black 0	Yellow 2
Red 1	White 3

Figure 2. Colour table for mode 1

The numbers 23 and 224 tell the computer that you are defining character 224. The other numbers are the sum of the shaded squares of each horizontal line. PRINT CHR$(224) will print this shape.

To produce the whole owl repeat this process for each 8 x 8 matrix, not forgetting to store the numbers in different characters (the third and sixth shapes are the same so have to be defined only once).

'The emblem may be drawn anywhere on the screen'

Part 4

Line 2090 causes the variable design$ to be all the characters of the owl added together, so the command PRINT design$ will print the owl. (The CHR$8 command causes the cursor to move back one space and the CHR$10 command causes it to move down one line.) Now add in line 15 PROC_design so that the computer will know what the defined shapes are.

The next stage is to print the design on the back of the cards. To do this we define a procedure which will be called when the blank card has been drawn.

Part 5

To call this procedure you have to add a line to the procedure called PROC_draw _card. If you copied out method 1 add:

1065 PROC _ print _ design (x _ coord + 70, y _coord + 170,1)

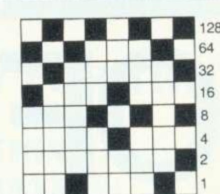


Figure 5. Converting the pattern into numbers

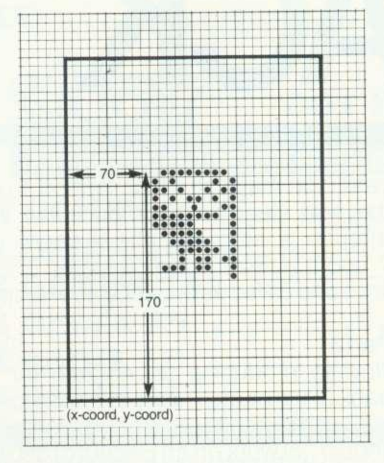


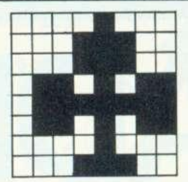
Figure 6. The design is positioned on the card

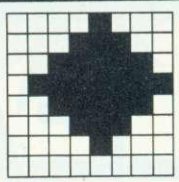
If you used method 2 add:

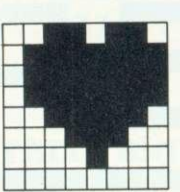
1045 PROC _ print _ design (x _ coord + 70, y _coord + 170,1)

The reason for the added numbers can be seen in figure 6.

The top right of the owl emblem is 70 dots further along the horizontal line and 170 dots higher up than the bottom right of the card. Line 3010 joins the text and graphics cursors so that the emblem may be drawn in an exact position anywhere on the screen instead of just any one of 40 positions on 32 lines.







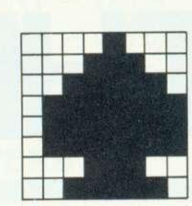


Figure 7. Shapes to suit – clubs, diamonds, hearts, spades

In PROC_print_design lines 3050 to 3100 just add a few lines to the back of the card.

Now that you have the card design all you need is to define shapes for hearts, clubs, diamonds and spades. This is done in the same way as the owl (figure 7).

Part 6

Add line 16 PROC_characters to inform the computer of the defined characters. So to print a specific suit you merely call PROC_characters and type PRINT club$ or heart$, etc.

You should now have the full program (listing 1).

Part 1

```
1000 DEF PROC_draw_card(x_coord,y_coord,
     colour)
1010 GCOL 0,colour
1020 MOVE x_coord,y_coord
1030 MOVE x_coord+200,y_coord
1040 PLOT 85,x_coord+200,y_coord+290
1050 MOVE x_coord,y_coord+290
1060 PLOT 85,x_coord,y_coord
1070 ENDPROC
```

Part 2

```
1000 DEF PROC_draw_card(x_coord,y_coord,colour)
1010 VDU 24,x_coord;y_coord;x_coord+200;y_coord
     +290;
1020 GCOL 0,128+colour
1030 CLG
1040 VDU 26
1050 ENDPROC
```

Part 3

```
 10 MODE1
 20 FOR card_positions = 1 TO 100
 30 READ x_coord,y_coord
 40 PROC_draw_card(x_coord,y_coord,7)
 50 NEXT card_positions
 60 END
500 DATA 360,55,620,55,880,55,360,375,620,375,
    880,375
```

Part 4

```
2000 DEF PROC_design
2010 VDU 23,224,170,65,136,20,136,65,160,80
2020 VDU 23,225,170,65,136,20,8,65,130,4
2030 VDU 23,226,170,85,170,85,42,21,10,5
2040 VDU 23,227,168,0,128,0,128,64,160,80
2050 VDU 23,228,2,1,2,85,0,0,0,0
2060 VDU 23,229,168,84,34,81,0,0,0,0
2070 VDU 23,230,128,0,128,0,128,0,128,0
2080 VDU 23,231,128,0,128,0,128,0,0,0
2090 design$ = CHR$224 + CHR$225 + CHR$230 +
     CHR$8 + CHR$8 + CHR$8 + CHR$10 + C
     HR$226 + CHR$227 + CHR$230 + CHR$8 + CHR$8 +
     CHR$8 + CHR$10 + CHR$228 + CHR$229
     + CHR$231
2100 ENDPROC
```

Part 5

```
3000 DEF PROC_print_design(x_coord,y_coord,colour)
3010 VDU 5
3020 GCOL 0,colour
3030 MOVE x_coord,y_coord
3040 PRINT design$
3050 MOVE x_coord-10,y_coord+80
3060 DRAW x_coord-30,y_coord+80
3070 DRAW x_coord-30,y_coord+60
3080 MOVE x_coord+80,y_coord-140
3090 DRAW x_coord+100,y_coord-140
3100 DRAW x_coord+100,y_coord-120
3110 ENDPROC
```

Part 6

```
6000 DEF PROC_characters
6010 VDU 23,232,8,28,28,107,127,107,8,28
6020 VDU 23,233,8,28,62,127,62,28,8,0
6030 VDU 23,234,54,127,127,127,62,28,8,0
6040 VDU 23,235,8,28,62,127,127,127,28,62
6050 club$=CHR$232:diamond$=CHR$233:
     heart$=CHR$234:spade$=CHR$235
6060 ENDPROC
```

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SOFT POTTERY

Malcolm Banthorpe, who brought graphics to life in earlier issues, now sets them spinning about an axis

THE graphics featured in my previous articles on 'Life' and 'Adding a new dimension to Life' (January and March 1984 issues) were largely confined to plotting cubes, each cube being displayed as the three surfaces assumed by the program to be facing the viewpoint. This assumption, coupled with the order in which the cubes were plotted, made it possible to implement a simple form of hidden surface removal without getting involved in mathematical calculation. I also showed how cubes can be used as building blocks for more elaborate 3D structures by using them as components of three-dimensional lettering.

At the heart of the programs was a procedure called PROCplot, which took four arguments and performed the perspective projection of 3D co-ordinates. The procedure, with one important difference, is central to the two programs in this article. To recapitulate on its use, a call to the procedure takes the form:

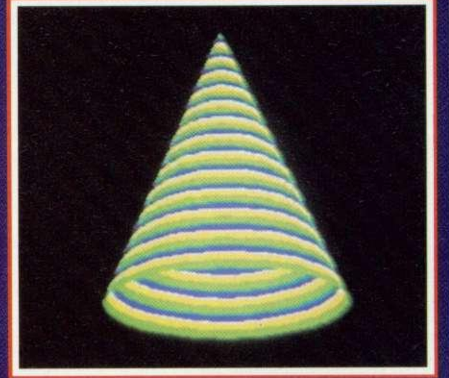
PROCplot (K, X, Y, Z)

where K is similar to the first argument of a Basic PLOT command and determines whether the action will be a move, a solid or dotted line or a filled triangle. The remaining three arguments correspond to X, Y and Z co-ordinates. The procedure as given previously also contained limited provision to rotate a point around the origin of the X and Y axes.

The difference in the new version is that its action is limited to perspective projection and three new procedures are



A sphere . . .



A cone . . .

defined to give independent rotation around the X, Y and Z axes. This offers more flexibility in the way that shapes can be manipulated.

Armed with the general-purpose PROCplot, it is possible to draw a wire-frame representation of just about any shape, provided you are able to specify the co-ordinates of all the vertices in the form of data statements. Therein lies a possible snag. Anyone who has tried compiling such a set of co-ordinates would probably testify that it can be tedious to work out in advance all the vertices of anything but the simplest of three dimensional shapes.

The shapes featured here neatly side-step the hard work by having their co-ordinates entirely defined as well as plotted by the computer. All the shapes are the result of rotating a two-dimensional profile around a vertical axis. As it is possible to rotate the shapes themselves, the axis of rotation does not have to appear vertical on the display. Some of the results can have the appearance of vases and other 'thrown' pottery – hence the title. Both programs are software versions of a potter's wheel – and you don't get your hands dirty.

By rotating a single vertical line around a vertical axis we can get some suggestion of the outline of a cylinder (figures 1 and 2). Figure 2 consists of the ten images of the line that results from rotating it through one complete revolution in 36 degree steps. So far it doesn't look very promising as there is not enough depth information to make it clear that these ten lines represent a cylinder.

A considerable improvement is gained by linking the lines with a series of horizontal rings (figure 3). The surface of the cylinder is now broken down into a series of facets and begins to look more like a normal wire-frame representation. As with all such images there is some ambiguity and there is nothing like a real curve, only straight-line approximations. This version succeeds to some extent because the perspective effect of making the nearer facets appear larger than those on the rear surface helps interpretation of the two-dimensional image as having depth.

The program of listing 1 (yellow page v) draws this cylinder and other wire-frame solids which can be described by rotating a profile. PROCrotateX, PROCrotateY



A gourd . . .

and PROCrotateZ allow the rotation of any co-ordinates around the X, Y and Z axes respectively. A procedure call takes the form:

PROCrotateX (X, Y, Z, A)

which will rotate the point X, Y, Z by A degrees around the X axis. The rotated co-ordinates are returned in the variables x%, y% and z%. The other two procedures operate similarly and also return the co-ordinates in x%, y% and z%. While PROCrotateY is used to generate the shape's outline, PROCrotateX and PROCrotateY can be used to rotate the whole shape.

The program starts by asking for a function describing the profile to be typed in. To draw a cylinder, simply enter any number corresponding to its radius. Something in the order of 400 or 500 is a suitable value. Next, the program asks for rotation (in degrees) around the X and Z axes. To save processing time, PROC rotate X and PROC rotate Z are not called if rotation angles of zero have been entered. To plot an un-rotated shape simply press RETURN when these angles are requested. Figure 4 shows six views of the cylinder obtained by entering various combinations of angles.

To change the overall shape we need to modulate the rotated line. The simplest variation is probably to make the line slope towards the axis of rotation. This can be achieved by entering the functions:

50*(10−V%)

(V% is the variable used by the program to hold the vertical step number. There are ten vertical and ten rotational steps.)

The result is the cone of figure 5. Both angles of rotation are zero in this illustration but the cone can be moved around, as the cylinder was, to give the effect of a changing viewpoint.

The profile to be rotated is initially stored by the program in the array called Profile%

If the function to be plotted is now entered as:

SQR (500 2− (500−V%*100) 2)

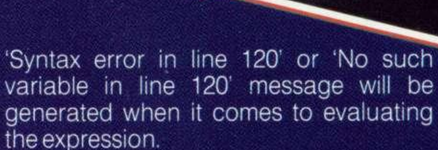
a crude version of a sphere is drawn (figure 6). This is not particularly satisfactory as a representation because the facets are too large to allow more than a rough approximation of a curved surface.

Other variations in the shape are possible by substituting functions for more complex profiles (figures 7 and 8). The function used here was:

300+220*SIN (1+V%/2)

In figure 8 it has been tipped forwards by entering an X rotation of −60 degrees. The possibilities for generating new rotated shapes are limited only by your patience to enter expressions and wait to see what appears on the screen. Bearing in mind that V% varies in value from 0 at the base to 10 at the top of the shape, the maximum absolute value of any function you enter should not exceed 600, otherwise part of the plotting will be off the screen.

If you can't think of any different functions, try changing the numbers in the examples sgiven so far, or even substituting RND functions. In general, sine and cosine functions lend themselves well to curves of this kind but just about anything you can think of is worth a try – but make sure the syntax of the function you enter is valid, otherwise, although initially accepted by the program, a



'Syntax error in line 120' or 'No such variable in line 120' message will be generated when it comes to evaluating the expression.

A couple more suggestions to try in this program are:

100*(5−V%)

and

300*COS (1.5*V%*PI/10)

There are two main ways in which the appearance of these shapes can be improved, both incorporated in listing 2. First, to improve the smoothness of the curves, the number of facets is increased by quadrupling the number of vertical steps and increasing the number of rotational steps from 10 to 72. This increases the number of facets from 100 to 2880 and inevitably the time required to plot them all. Second, to remove much of the ambiguity in the image, a simple form of hidden surface removal is employed. Each facet is drawn as a filled quadrilateral rather than just an outline.

The idea behind this is similar to that used on the cubes in the previous article. Facets are drawn starting with those that are assumed to be furthest from the viewpoint so that they will subsequently be erased by any facets plotted later, which theoretically lie between them and the viewpoint. This will work for only a limited range of rotations of the shapes but it is much simpler than other methods of hidden surface removal.

The exact degree of rotation possible will be different for each function plotted as it depends to some extent on the nature of the shape. A certain amount of experiment will be needed to give you some idea of what is possible. It is always safe to start with an upright shape (X and Z rotations of zero).

Listing 2 again starts by asking for the function to be plotted. As mentioned, plotting takes considerably longer, even to reach a stage which gives a reasonable idea of the final shape. To save wasting time on plotting unpromising shapes, the program next draws the profile as a single line and asks whether you want to continue. The vertical axis of rotation is also shown as a dotted line. The plot may therefore be abandoned at this stage and another function entered.

A suitable function to try first would be:

300+220*SIN (1+V%/8)

If each of the facets was simply plotted as a uniformly filled quadrilateral then they would all merge together visually, for the edges of the facets would not be visible. The result would be a flat shape with the 3D effect lost. One solution would be to plot the edges in a different colour to give a surface grid effect not unlike the wire frames of the first program. An alternative, incorporated in this program, is to plot adjacent facets in different colours and thus give the shape a surface pattern.

The colour can be determined by a second function of the vertical and/or rotational steps. The function chosen should return a range of values from 1 to 3 as plotting is done in mode 1 and there are three logical foreground colours available. The background is logical colour 0, black unless otherwise defined. The program therefore next asks for a function to determine the surface pattern. A suitable function to try is:

1+V%MOD3

which will give a series of horizontal stripes. The variable V% again holds the vertical step number from 0 to 40, while H% holds the rotational position and is incremented in steps of five from 0 to 180. The shape is drawn in two halves and a variable S%, which has the value of either −1 or 1 depending on whether the right or left half of the shape is being plotted, may also be included in the pattern function. The colours displayed can, of course, be varied by means of the VDU19.... statement in line 270.

In most other respects the second program behaves like the first, and most of the same shape functions can be used if they are modified to take account of the increased number of vertical steps. The cone function becomes:

12∗(40−V%)

and the sphere function becomes:

SQR (500 2 − (500 − 25∗V%) 2).

Again, the variety of shapes that can be plotted is limited only by your willingness to try out different functions. The hidden-surface effect will not work if the profile crosses the axis of rotation, though the result may still be interesting. In other words, the preliminary profile drawn by the program should not cross the dotted line and should remain to the right of it if



'The exact degree of rotation possible will be different for each function plotted as it depends on the nature of the shape. Some experimentation will be needed'

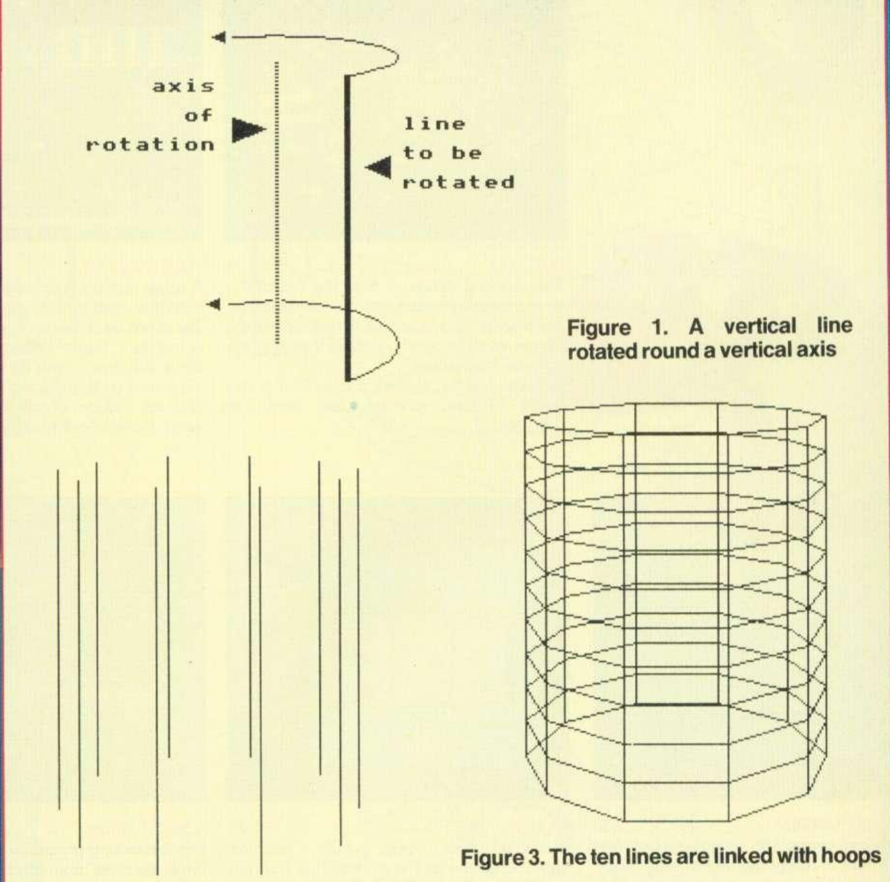
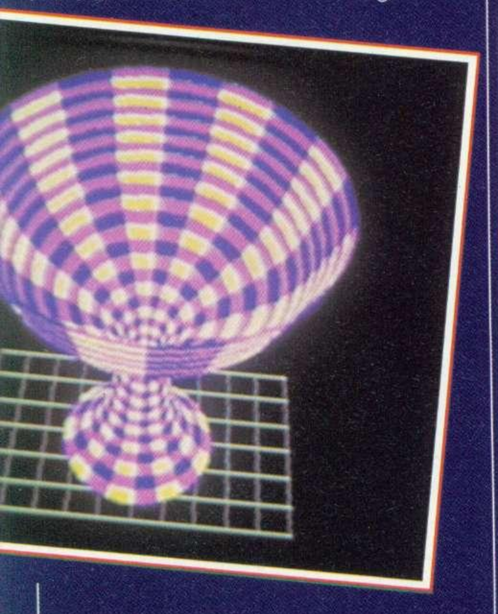


Figure 1. A vertical line rotated round a vertical axis

Figure 2. The cylinder emerges

Figure 3. The ten lines are linked with hoops



... These are the possibilities of an outline rotating round an X axis. Above and left is a single shape at two different angles of rotation in which the hidden surface effect is maintained. A regular grid has been added as a base.

you want a realistic-looking display. You may find it interesting to try writing a procedure using PROCplot and the rotation procedures to draw a grid for your vessel to stand on. The lower edge of all the shapes is centred at co-ordinates 0, −500,0.

Here are some more functions to try:

Profiles

300+220∗COS
(V%/5∗.5)−100∗SIN (V%∗.375)
300+250∗COS ((40−V%)/8.8) −25
∗SIN ((40−V%)∗.375)

Patterns

1+(((H%∗S%+180+ (S%=1)) DIV
20+V%DIV4)) MOD3
2+ (H%DIV5− (S%=1)) MOD2
1 + ((H% ∗ S% + 180) DIV5 + V% +
(S%=1)) MOD3

PROCplot, PROCrotateX, PROCrotateY and PROCrotateZ constitute a suitable starting point for a wide variety of 3D plotting tasks. I hope these and the illustrations on these pages give readers otherwise deterred by the mathematical treatment of the subject in many text-books the tools and the inspiration to develop their own ideas.

See page 71 for the remainder of the wireframe figures developed in the text of this article.

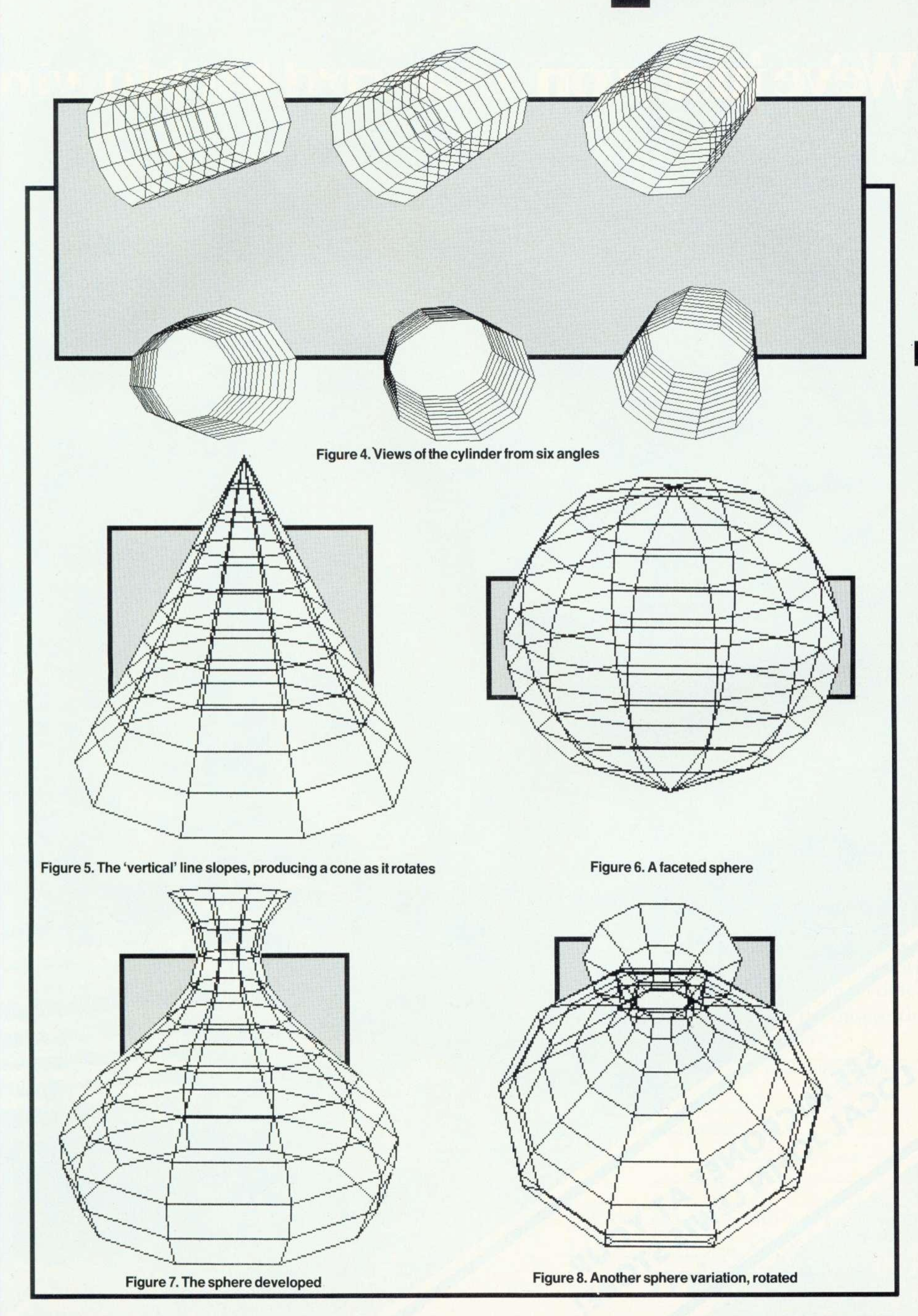


Figure 4. Views of the cylinder from six angles

Figure 5. The 'vertical' line slopes, producing a cone as it rotates

Figure 6. A faceted sphere

Figure 7. The sphere developed

Figure 8. Another sphere variation, rotated


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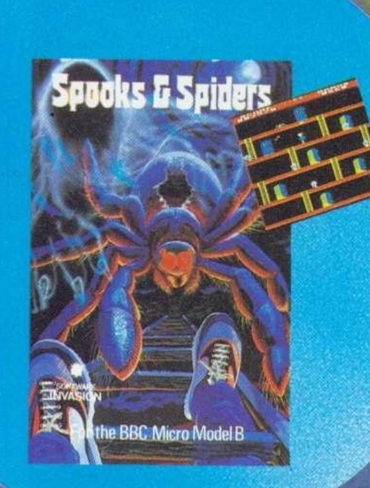


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BASIC INCREASE IN SPEED & SPACE

Time yourself as your technique improves, says Gary Smallridge



THE BBC Basic interpreter is fast in execution, but some Basic programs need to run really fast – for arcade games, sorting and searching, for example. An experienced programmer would probably use machine code for time-critical operations but the less adept programmer has to make do with the Basic interpreter.

The following guide is intended to help novice users of BBC Basic (and also Electron users) with writing programs. It is a collection of useful tips and experience gained in writing programs for the BBC machine and a Basic interpreter for a DEC VAX.

Improving program speed

1. With expressions, remove common denominators. For example, consider the following Basic line:

A=B/100+C/100

Removing the division by 100 and placing outside the expression will improve speed, ie:

A=(B+C)/100

Try typing in program 1 and running it. Note the time taken and then type in this modification to line 60:

60 A=(B+C)/D

Notice that the running time taken this time is 31 per cent less than the previous time!

2. Multiplication is generally more efficient than using division. This can be demonstrated by typing in the following modifications to the program and running it:

30 D=0.01
60 A=(B+C)*D

The gain in speed isn't much this time – only 4% – but if points 1 and 2 were both adopted in the same program, the overall improvement would be as much as 33 per cent.

3. Avoid GOTOs wherever possible, otherwise the interpreter has to search through the whole program to find the destination line number. In contrast, with REPEAT ... UNTIL or FOR ... NEXT constructs, the interpreter 'remembers' where the start of the loop is.

4. FOR ... NEXT loops are faster than REPEAT ... UNTIL loops and REPEAT ... UNTIL loops are faster than IF ... THEN GOTO loops (see *User Guide*, page 194).

5. Using GOSUBs is faster than using PROCedures. Although this greatly reduces the readability of the program, it will speed it up. This is contrary to what the *User Guide* says on page 195 but can

```
10 REM Program 1
20 B=2:C=3
30 D=100
40 T=TIME
50 FOR I=1 TO 1000
60   A = B/D + C/D
70   NEXT
80 PRINT"A=";A,"Time="
   ;TIME-T
```

```
>RUN
A=5E-2      Time=574
>60 A = (B+C)/D
>RUN
A=5E-2      Time=396
>30 D=0.01
>60 A = (B+C)*D
>RUN
A=5E-2      Time=379
```

Program 1.

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```
   10 REM Program 2
   20 T=TIME
   30 FOR I=1 TO 1000
   40   PROCS
   50   NEXT
   60 PRINT"A=";A,"Time=";
      TIME-T
   70 END
   80
 1000 A=A+1
 1010 RETURN
 1020
 2000 DEF PROCS
 2010 A=A+1
 2020 ENDPROC
>RUN
A=1000      Time=249
>40 GOSUB1000
>RUN
A=1000      Time=229
```

Program 2.

easily be proved by typing in program 2 and running it, and then adding the following modification and running it:

40 GOSUB1000

The gain in speed is about 8 per cent.

6. When used as a subscript to index an array (for example, BOARD (I%)=0) an integer is faster, because the interpreter does not have to decode the integer number, unlike real numbers.

7. Long variable names are slow to interpret, short variable names are quicker – this includes integer, real and string variables and also procedure names. Although this again reduces readability, it improves running time. Also, don't start variables or procedure names with the same letter. Spreading them from A through to Z will make a difference. An ideal situation would be to develop the program using long variable names and then to use a utility to change globally the long names to unambiguous short ones, ensuring, of course, that they don't start with Basic keywords.

8. Putting lines of code on one line using the colon delimeter speeds run-time execution. This is because the interpreter does not have the additional overhead of decoding the line number. Try putting the whole of program 1 on one line and re-running it.

9. Spaces, blank lines, REMarks, etc, although aiding readability, are an additional overhead at run-time. Another useful utility for the serious programmer would be a program to remove redundant spaces, blank lines and REM statements from the source, producing a compacted, fast-running program. There are a number of ways this can be achieved. One is *Toolkit*, available from Beebug. A useful ROM as all that is needed is a single command (*PACK) and the utility removes all spaces, REMarks and blank lines and informs you just how much space you have saved. There have also been a few machine code programs that do the same thing, but these have to be loaded into an area of memory not occupied by the program.

10. Put the most likely false condition first in IF statements when conditions are separated by the AND Boolean operator, and to the right of this the descending likelihood of being false. For example:

IF A=B and C=D and E=F THEN...

If the condition 'E=F' is the most likely to be false, 'C=D' next likely, then rearrange thus:

IF E=F AND C=D AND A=B THEN...

The reason for doing this is that the interpreter will stop comparing when the first condition it meets fails the test. Of course, this will be done only after the interpreter has arranged the conditions into its internal form for most efficient evaluation.

11. Use Boolean algebra to evaluate conditional expressions so that they contain as few operators as possible, for example:

IF A=B AND C=D OR E=F AND C=D OR G=H AND C=D THEN...

should be arranged as follows:

IF (A=B OR E=F OR G=H) AND C=D THEN...

With Boolean algebra the operators, AND, OR and NOT can be considered similar to the arithmetic operators *, + and −, respectively. The same arithmetic rules can then be applied to remove common subexpressions.

12. POKEing memory is faster than using byte arrays, but this method doesn't work across the Tube, for example:

```
10 ?&B00=1
20 I=?(&B00+1)
```

Line 10 puts the value 1 in location &B00 and line 20 stores in 'I' the contents of location 1 offset by &B00 – ie location &B01. This is similar to the byte array description given in the section on reducing program size (see below).

13. The THEN keyword in an IF ... THEN statement is optional and may be omitted to improve speed, for example:

IF A%>8 A%=A%+1 ELSE A%=3

14. An expression can contain an in-line implicit IF statement, remembering that TRUE has the value −1 and FALSE the value 0, for example:

Z%=A%>0

will set Z% to −1 if A%>0 or to 0 if not. Also, they can be more complex, for example:

A%=−(A%>8)−3*(A%<9)

The above line might look a bit off-putting at first, but this is what happens:

a) if A%>8 and A%<9 implies A%=−(−1)−3*(−1) which is 4
b) if A%>8 and A%>=9 implies A%=−(−1)−3*(0) which is 1
c) if A%<=8 and A%<9 implies A%=−(0)−3*(−1) which is 3
d) if A%<=8 and A%>=9 implies A%=−(0)−3*(0) which is 0

Also, expressions using implicit IF statements are fast in execution, but they take up more space. Space can be saved as this format allows multiple conditional statements in a single line, which is not normally possible.

Reducing program size

The size of a program can be reduced by using short variable names, but its readability is reduced.

Bear in mind that arrays start from subscript 0, not 1 as in most Basics. This will gain a few bytes in the interpreter work area if you use the subscript 0 and dimension the array by one less.

page 84 ▶

RAPID RETRIEVAL TAPED

Storage made easy, by John Bexon

THE program called *Loader* (listing 1, yellow page vi) makes possible rapid retrieval of any selected program previously stored, but you will need a tape recorder with both motor control and a tape counter. The program will work with any model BBC and Electron.

In its fullest version it requires about 4k of memory in addition to that occupied by any program on which it is to operate. But since the program runs in mode 7 (mode 6 on the Electron) this should not impose much restriction on memory use, and removal of all REMs and spaces can reduce memory requirement. If the presence of *Loader* prevents a program from running in, say, mode 0 you can overwrite it when loading.

First, *Loader* has to be typed in. If you have an early version BBC with OS0.1 then you should add the lines in listing 2 to the main listing. The program should be saved at the beginning of a blank tape. Start recording just beyond the tape leader.

Follow the instructions in table 1 when saving programs. When the routine is finished your program will have been saved and a new version of *Loader* will have been recorded at the beginning of the tape that includes data on the program saved.

Having a number of programs saved on the tape with *Loader* at the beginning, loading a selected program is carried out using the procedure in table 2. It will soon become evident, especially with short programs, that having to load the loader as well as your selected program is time-consuming, but random searching, using *CAT to find your program and false LOADs will all be eliminated. Instead an accurate and rapid search and load routine is available.

Furthermore, when you have enough programs on the tape large sections of the loader program can be deleted. For example, all the SAVE and associated routines will no longer be required. Thus the length of the program can be reduced to little more than 1k.

Loading time, however, is the critical factor rather than memory requirement since your selected program may eventually overwrite the loader. Short programs will load in less than 30 seconds.

The program uses many of the special features of the BBC micro, such as user-defined function keys, procedures, functions, automatic tape motor control and byte and string indirection.

The February 1983 issue of *Acorn User* introduced a technique whereby programs may directly alter sections of themselves. This technique is used in *Loader* to insert a new data statement into the program each time a new program is saved. In this way fast-forward wind-on times of the tape are recorded for subsequent use when you are loading programs.

When first loaded, or typed in, the loader program contains only one data statement at line number 1001, ie, DATA Loader,1100,1. This consists of the name of the program, the fast-forward wind-on time for the start of the next program and the number of the program. The fast-forward wind-on time of 11 seconds (1100 centi-seconds) is necessary to leave room on the tape to record a longer loader program each time the program extends itself by a one-line data statement for each new program saved.

Since there is only one data statement at this stage, and the program attempts at Line 630 to restore data at line 1002, any attempt now to load another program using *Loader* will result in a 'No such line' error. No attempt has been made to trap this error.

The first thing to do therefore is to record one or more programs using the procedure given in table 1. If step 2 is omitted the program will ask you to start again because it is essential to have the program to be saved in the lower part of user memory, ie, starting at PAGE=&E00. The position of PAGE is then changed by step 3 so that the loader can be held in memory simultaneously with the program to be saved. (The positions are reversed when loading.)

It is not sufficient to set PAGE=TOP since PAGE is always set by the computer to the next lower page boundary; for example, if TOP=&19F1 PAGE would be set to &1900 and the end of your program would be overwritten by the loader. Consequently, PAGE is set to TOP+256 to make sure that the new value, when rounded down, is clear of the first program.

The *User Guide* (page 317) warns of a danger here but does not explain the problem or give a solution.

Loading *Loader* starting at the new value of PAGE now allows the loader program to operate on the program to be saved. As *Loader* extends itself it is liable to overwrite its own variables which are normally stored in memory immediately above the Basic program area. To avoid this, overwriting LOMEM is raised by half a block in line 50.

Line 60 sets aside a memory block to be used by the command line procedure, PROCcli(cl$), to pass SAVE commands to the computer's command line interpreter so that saving can be carried out from within the program.

Next, in line 80 the break key is set to allow a jump back to the lower program after the SAVE routine.

If you have a BBC OS version 0.1 the next section of the program, including a new line 80 and up to line 230 from listing 2, is a slightly modified version of the patch, as published in the September 1982 issue of *Acorn User* (page 61) to cure bugs in the cassette filing system. It is convenient to load this patch here so that

1. Type in or load from another tape the program to be saved
2. Type PAGE=TOP+256
3. CHAIN the loader program and leave the cassette in the recorder
4. From the menu presented choose option 2 (SAVE)
5. Follow the program's instructions and answer the questions that appear on the screen (a single keypress – Y for yes – is mostly all that is needed apart from operating the cassette recorder). When the computer prompts 'RECORD then RETURN' the tape recorder should be set to RECORD and after no more than one or two seconds the RETURN key should be pressed (this sequence occurs twice during the SAVE routine)
6. Repeat this procedure for each program to be recorded on the tape

Table 1. Saving programs using 'Loader'

there will be no difficulties with saving and loading after using the loader (Electron and BBC users of OS > 1.0 must omit this section of the program).

Next (lines 250 to 270) the initial menu is presented. The byte indirection in line 260 ensures the use of upper case characters when you choose from the menu. Otherwise the program will hang up at line 270, which accepts only characters 1 or 2 as valid input. (?216=48 can be used to obtain lower case letters – ie this byte indirection sets the CAPS LOCK.)

If the save option is chosen you will be asked to input the name of your program before starting the procedure PROCsave at line 310. First, this procedure used the function FNC(TP%) to look back from the end of the program to find the number in the last data statement of the last program recorded. Then from this number the line number of the last data statement can be calculated simply by adding 1000. It is important therefore that the loader program should always have data statements numbered from 1001 onwards – so beware if renumbering. The ability to RESTORE a particular data line is then used to read data for the last program recorded so that the fast-forward wind-on time to the end of the recording can be used to position the tape ready to save the next program.

The tape is rewound to the beginning, as this position provided a constant reference point for all wind-on times. The procedure PROCrew does the rewinding. PROCff simply checks that you are ready for the fast-forward wind-on. Lines 370 to 380 carry out the winding on for the time S% which was read from the last data statement. When the tape stops and you have pressed the stop key as instructed you are ready to make your new recording. This is done simply by setting the recorder to RECORD and pressing return. As indicated in table 1, a short pause before pressing RETURN is all that is needed. Any more than 1 or 2 seconds will mean a longer wait when subsequently loading the program.

Having saved the program, it remains to record the new fast-forward wind-on time. The program now takes you to PROCdata, where you rewind to the beginning of the tape again and the computer measures the fast-forward time to the end of the program. You have to help by watching the tape counter and pressing any key when the end of the latest recording has been reached. Overshoot somewhat when doing this to leave a gap on the tape before the next program to be recorded. Stopping the tape short of the appropriate point is, however, potentially disastrous as the next recording could overwrite the end of the present one.

The computer now has all the information to create a new data line which it does by generating the text of the line as a string, N$, in line 500. This string consists of a space, the name of the program number, all concatenated into N$. Contrary to the description of the line structure in BBC Basic given by Joe Telford in *Acorn User*, February 1983 (page 22) it is actually as shown in figure 1. (Try programming

> Line number – 2 bytes
> Line length – 1 byte
> Basic keyword token – 1 byte (&DC for "DATA")
> Line contents – of variable length in ASCII form
> Line feed (End of line marker) – 1 byte (&0D)
> End of Basic program market – 1 byte (&FF)

Figure 1. Line structure at end of program

key f9 as follows and use this key to examine how the end of the program is stored in memory from TOP downwards:

```
*KEY 9 FOR N% = TOP TO
(TOP – 21) STEP
– 1:PRINT;N%,?N%;SPC(3);:IF
?N% < 32 PRINT:NEXT:ELSE PRINT
CHR$(?N%):NEXT|N|L|M)
```

The text, N$, of the line must therefore be preceded by four bytes – line number, line length and Basic keyword – and followed by one byte: line feed, ie, five bytes. The two bytes for the line number are calculated in line 510 from (1000 + program number) and the line length in line 520 from the length of N$ plus the five extra bytes. All this information, together with the end of program marker, is then concatenated into P$ and string indirection used to POKE it where the previous end of program was situated.

Finally the new loader has to be recorded at the start of the tape, so a final rewind is necessary, followed by a short fast-forward to jump over the tape leader. After the stop key on the tape recorder has been pressed the loader is saved by setting the recorder to RECORD and pressing RETURN in quick succession.

If you wish to return to your original program, pressing BREAK will reset PAGE and run the program. If, however, you wish to use *Loader* to load another program first press BREAK and then ESCAPE and follow the instructions in table 2.

Clearly, when you have many short programs or several long ones recorded on one tape the fast-forward wind-on times for the later programs will become tediously long. Short tapes, say C15, should be used – certainly none longer than C30.

When you have recorded on one tape as many programs as you feel are convenient it is possible to reduce loading times by deleting sections of the loader program that are no longer required. Before doing so, make a copy of *Loader* on a new tape, unless you have a back-up copy. Pruning is best done before finally saving *Loader* after recording the last program on the tape. Thus, during the final save routine, after pressing stop on the tape recorder press ESCAPE and type DELETE 250,590 followed by RETURN. This erases the initial menu (since you will want to load only from this tape in future) and all parts of the program associated with saving. In addition you may also remove all REMs and blank lines, reducing loading time for the loader to a minimum. However, resist the temptation to renumber the program after pruning – remember that the data statements *must begin at line 1001*. When starting to use your copy of the full version of *Loader* on a new tape remember to delete all lines above, but not including 1001.

When pruned, *Loader* shows its true worth. Any program on the tape can now be accessed with a minimum of bother, having been easily selected from a clearly presented index which itself gives a quick listing of the contents of the tape.

1. Wind to the beginning of the tape and CHAIN the loader
2. From the menu presented choose option 1 (LOAD)
3. Select the program of your choice from the list presented or press the space bar (if you inadvertently reach the end of the list press Y when asked if you wish to try again). When you see the name of the program you wish to load select the number indicated
4. Follow the program's instructions and answer the questions that appear on the screen. The computer will then control a fast wind-on to the start of the program and you will be asked about memory requirement of the program
5. If in doubt about the amount of memory needed, respond by pressing any key except Y. The program will now CHAIN the program, unless a 'No room' error occurs
6. If a 'No room' error occurs press BREAK and try again, but choose the maximum memory option this time
7. You may return to *Loader* at any time by pressing BREAK except when *Loader* has been overwritten after choosing the maximum memory option

Table 2. Loading a program

◀ page 79

When using FOR loops that have integers as their indexes and increment values, try to use the same variable (except for nested loops) – for example, I%, J%, K%. Creating unnecessary variables will consume stack space, the free area between TOP (end of program) and HIMEM (bottom of display area). The interpreter allocates an area in this region (starting at the value of LOMEM) for the variable names, variable type (real, integer, string or array of either type) and the address of its value.

The resident integer variables (A% to Z%) are already allocated by the interpreter, so if these are used the interpreter doesn't spend time creating the space for them (page 66 of the *User Guide*).

With BBC Basic a real number will use five bytes of memory whereas integers (eg, I%, FRED%) use only four bytes (a fact I keep forgetting as I use a variety of computers in my job).

Using multiple line statements saves five bytes for each line number (pages 54 and 98, *User Guide*).

Pre-declaring strings causes the interpreter to allocate the string space once only.

Declare strings to the maximum length that they will become in the course of the program, for example:

```
A$=STRING$(25," ") or
A$=STRING$(255," ")
```

The interpreter doesn't do any garbage collection; when a string is first declared, for example A$="FRED", it allocates the space needed to store the string – in this case five bytes (one byte for the count), but if any subsequent declaration causes the string to be lengthened, the original space is lost (de-allocated) and new space reserved (allocated) for the longer string.

If, when using arrays, the values stored in the array are all integer and are in the range 0 to 255, byte arrays can be used to remove the three redundant bytes per array element, for example:

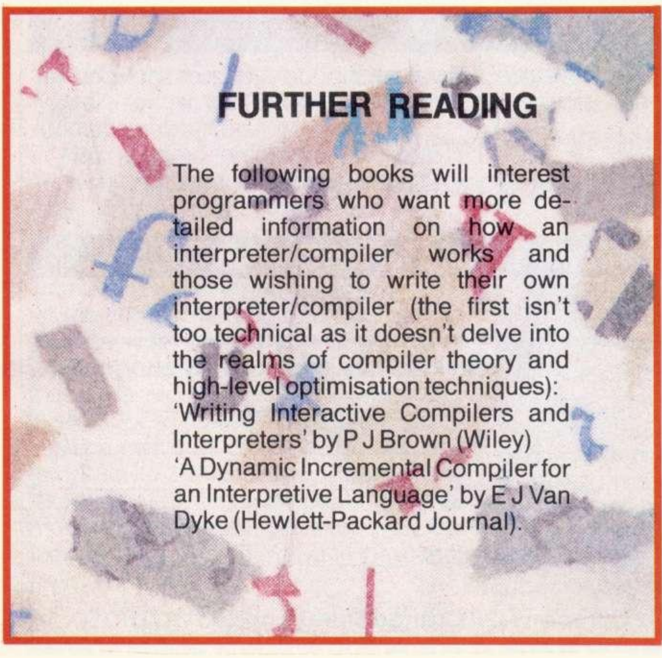
```
DIM BOARD 128
```

The byte array BOARD is then accessed by:

```
BOARD?I%=0
```

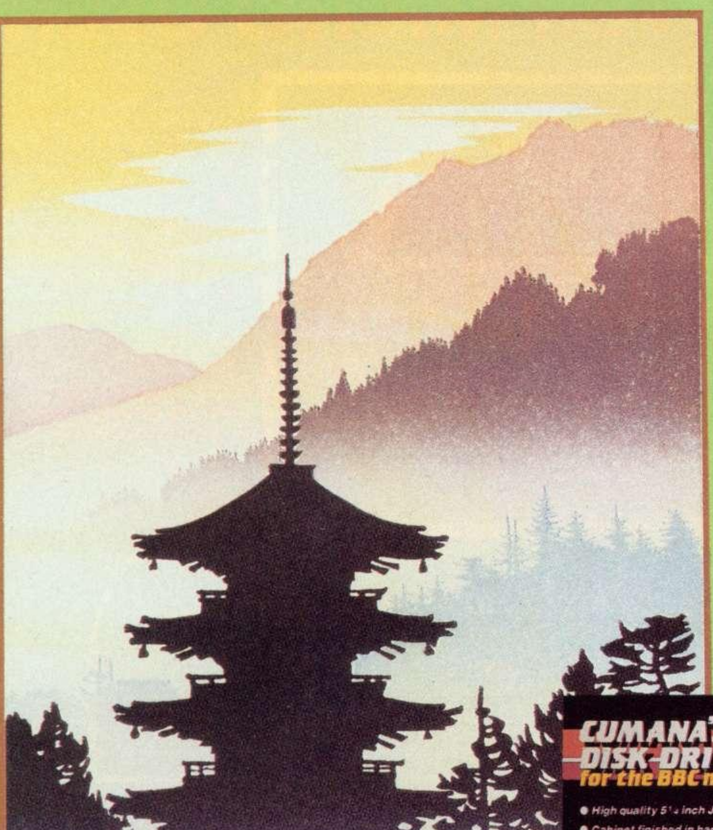
and

```
X=BOARD?1
```



FURTHER READING

The following books will interest programmers who want more detailed information on how an interpreter/compiler works and those wishing to write their own interpreter/compiler (the first isn't too technical as it doesn't delve into the realms of compiler theory and high-level optimisation techniques):
'Writing Interactive Compilers and Interpreters' by P J Brown (Wiley)
'A Dynamic Incremental Compiler for an Interpretive Language' by E J Van Dyke (Hewlett-Packard Journal).



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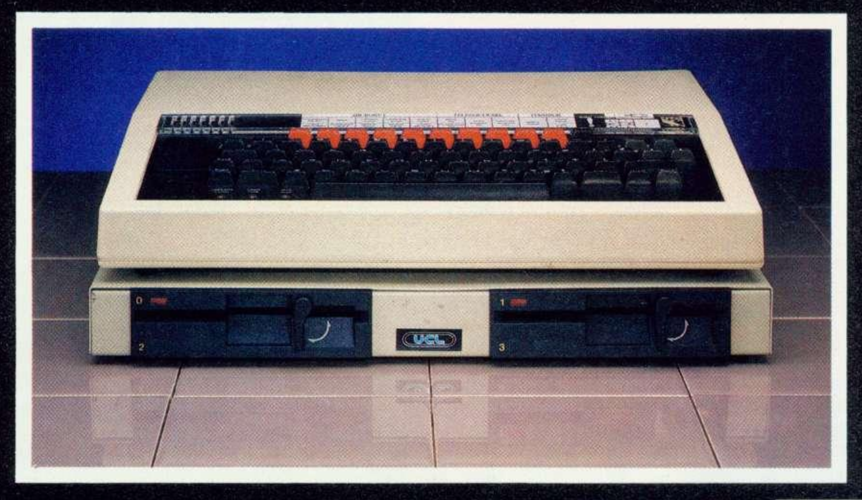
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EAVESDROPPING ON MEMORY

See a program actually working! In the first of a series on the Beeb and Electron, Paul Beverley opens the lid on the inner workings of these very complex machines

THE idea of this article is to provide a means by which the inner workings of the Electron and BBC micro's random access memory can be made visible on the screen. The technique used is simple, as it is just a matter of re-programming one of the registers of a chip. This is the 6845 CRT controller chip whose job it is to look at the contents of the video RAM and generate, in conjunction with the video processor chip, the signals used to produce pictures on a television or monitor screen (see April's issue).

All we have to do is tell the 6845 that video RAM starts at page zero and not where the operating system says. To get the required effect, type in:

```
MODE 6
VDU 19,0,4,0,0,0        (or VDU 19;4;0;)
```

to select graphics mode 6 and change the background colour to blue. Then type

```
VDU 23,0,12,0,0,0,0,0,0,0  (or VDU 23;12;0;0;0;)
```

to do the necessary re-programming of the 6845.

The effect produced is quite startling when first seen. But before trying to explain what it all means, we need to look at how the screen is displayed in mode 6.

Each character on the screen is made up from the information contained in eight consecutive bytes of the screen memory. The next character is then made up from the next eight bytes and so on. Type in run program 1 (see yellow page vii), then each time you press the space bar one more byte will be added to the screen. Eight key presses will give a complete character. Continually pressing the space bar will produce more characters, eight bytes at a time.

The bytes the program is using to poke into the screen RAM are taken from the operating system ROM chip. Stored in memory locations &C000 to &C2FF are bytes defining each of the characters used in modes 0 to 6. (Mode 7 on the BBC has its own character generator in the teletext chip – hence the different character set.) If you want to see the characters much more clearly, run program 2 which displays them in large block form.

Now let's get back to that impressive display we first looked at. To show it more easily and play around, I have included it in program 3. However, before it is loaded in, the user's program space must be moved out of reach of our newly-defined screen which is to occupy memory locations &0000 to &1F3F. (No, that's not a typing error, it should be &1F3F, since 40 x 25 x 8 = 8,000 = &1F40. The reason mode 6 uses &2000 bytes is that as the screen is scrolled, it sometimes makes use of locations from &6000 right up to &7FFF.)

Moving the user program space up can be done by typing:

```
PAGE = &3000
NEW
CHAIN "BEEBWRK"
```

This assumes you have already typed program 3 in and saved it on tape or disc. (Disc users can make life easier by making the above three commands into a !BOOT file by using the *BUILD command, and entering *OPT 4,3 to set up the disc for an auto-boot. To run the program, just hold the shift key down and press break.)

Having got the flickering bit pattern on the screen, what does it all mean, and how do we interpret it? First of all it shows, if you ever doubted it, that although the micro might appear to be 'doing nothing' it is in fact working all the time.

To refer to different parts of the screen, each line can be thought of as divided up into five sections, each equivalent to eight characters, ie 8 x 8 = 64 bytes. Thus the first four sections of the first line (4 x 64 = 256) are locations 0 to &FF – what we call 'zero page'. One page is 256 bytes. If we refer to these 64-byte sections by their line numbers and section numbers then section 1,5 for example is the right hand end of the first line and is locations &100 to &13F. To check this type in:

```
?&100 = 0
?&13F = 0
```

to see where that is in section 1,5.

If you look at section 3,1 on the screen you will see a lot of activity. At the centre of that section is the regular 'ticking' of the micro's centisecond clock which is used for the TIME functions. To check this, try typing:

```
TIME = -1000
```

This should make two blocks of white appear. After 10 seconds (1000 centiseconds) these blocks disappear. What is happening is that the value of TIME is negative and is represented in binary as lots of ones – hence all the white. There are two complete blocks because the operating system uses two copies of the TIME value to avoid the danger of someone reading the value of TIME just as it is being changed under interrupt. Basic could have just got hold of the first byte when the centisecond interrupt came along. Basic would then pick up the other three bytes after the interrupt had been serviced and, if the TIME bytes had been changed, would give an erroneous value of TIME. Therefore the operating system uses the two sets of values alternately, and

only updates one while the other is being used for reading. Then it switches back and updates the other. The third set of numbers ticking away in step with the TIME bytes is the interval timer which can only be read and written to using OSWORDs 3 and 4. There is no Basic equivalent.

Immediately to the right of the time function is another area of activity, which is the buffer used by the operating system to store the current values from the analogue to digital converter. If you have joysticks, then changing their positions should alter the numbers also. (The best way to demonstrate this, if you can do a bit of soldering, is to make up a single potentiometer connected between Vref and analogue ground with its wiper connected to all four analogue inputs.)

Another way is to use *FX16,0 which switches off the four ADC channels, so all movement in that area ceases. Using *FX16,4 restores the movement as the four channels are re-enabled. With *FX190,8 you should be able to see the effect of changing to eight-bit conversion. However, it is difficult to tell the difference without a high-quality monitor, but program 4 makes the effect more visible. Try *FX190,8 and *FX190,12 before each run of the program and, in either mode, ADVAL returns the bottom four bits as zeros. In the 12-bit mode, the top 12 bits change with the positions of the joysticks, but with the eight-bit mode, the 11th and 12th bits are permanently at logic 1, while the other 10 bits change as the joysticks are moved. Therefore if you really only want eight bits you will have to switch over with *FX190,8 but then use, for example, ADVAL(1) DIV 256 to remove the top eight bits. The improvement in speed by going to eight bits is something less than 2.5 times. (In theory it should be 4ms compared with 10ms per conversion in the 12-bit mode.)

Before changing the contents of RAM too much it is worth getting some idea of what has happened to the RAM since the micro was switched on. When a reset occurs, the operating system detects whether it is a power-up reset, as opposed to the break key having been pressed, by checking whether any interrupts have been enabled on the system 6522 VIA chip. If no interrupts are enabled, it must have been a power-up reset and so the operating system clears all the RAM from &400 to &7FFF (&3FFF on a model A) to zeros, with the exception of the first byte of each page, ie &400, &500, &600 etc. Some of these can still be seen as white lines (&FF), eg the beginnings of sections 7,3; 8,2; 9,1 etc.

To see this actually happen, make sure there's nothing in the computer you want to keep, switch to mode 0, and get a bit map with:

```
VDU 19;4;0;
VDU 23;12;0;0;0;
```

Fill up memory by:

```
FOR N%=&D00 TO &5000: ?N%=-1: NEXT
```

and then type:

```
?&FE4E=&7F
```

This will disable all the interrupts on the internal VIA chip and so the system will stop completely. When you press break, the operating system checks the VIA, sees no interrupts are enabled, and clears memory. Watch carefully as you hit the break key to see the memory being swept clean, except the first byte of each page.

The other point of interest here is that by looking at sections 1,3; 1,5; 2,2; 3,2 and 3,5 you can tell what make of RAM you have in your computer! The different makes of RAM tend to power-up with different values, so those locations that have not

been over-written by the operating system or Basic will still show the pattern. Hitachi RAM tends to power-up with sets of 64 bytes equal to zero and 255 (&FF) alternately. Thus section 1,1 was all ones at power up, as was 1,3 and 1,5 etc. Other makes of RAM such as Mostek come up with alternate bytes equal to 0 and 255, so these appear as horizontal stripes.

There is always plenty of activity in section 2,3. This is the area of RAM called 'the stack' which the 6502 uses to remember numbers temporarily – for example, its return address when going off into a subroutine or to service an interrupt. It is this latter use that accounts for most of the activity when the system is sitting waiting for an input from the keyboard.

As soon as anything is typed in on the keyboard you will be aware of the characters going into two different areas of memory. The temporary buffer which the operating system uses is in section 4,1 and the line input buffer that Basic uses starts at section 6,4 and goes on up to and including section 7,3. Keys that show clearly what is going into the buffer are the space bar (ASCII 32 = 00100000 in binary) and the ~ tilde (ASCII 126 = 01111110).

If you type:

FOR S% = 0 TO 50000 : NEXT

and hold the space bar down, the buffer in 4,1 will fill up, and when Basic has finished executing the FOR ... NEXT loop, the space characters will be transferred to section 6,4 and printed out on the screen. If you now try the same thing, but use the tilde character, you will be able to see it happening even more clearly.

While the FOR ... NEXT loop was being executed you may have noticed extra activity in section 1,1 – the bottom part of zero page. This is a 'scratch pad' area being used by Basic, but in the middle of section 4,3 there was a number ticking away. This was the integer variable, S%, which you were using. Try again with say A% or Z%, or try entering Z% = –1. (Integer variables are represented by four bytes, as explained earlier, –1 in binary is all ones, so that gives a four-byte white block which should be clearly visible.)

To see why TRUE and FALSE take on the values they do, if you have just tried Z% = –1 try:

Z% = FALSE

and then

Z% = TRUE

TRUE is represented by minus one since that is all ones in binary, and FALSE is zero since that is all zero.

If you try any of your favourite SOUND and ENVELOPE commands, it will soon be clear where that all happens, and even doing a simple control-G shows that the operating system is counting something



```
C108 |  60 3C
C109 | 102 66
C10A | 102 66
C10B | 126 7E
C10C | 102 66
C10D | 102 66
C10E | 102 66
C10F |   0  0
C110 | 124 7C
C111 | 102 66
C112 | 102 66
C113 | 124 7C
C114 | 102 66
C115 | 102 66
C116 | 124 7C
C117 |   0  0
C118 |  60 3C
C119 | 102 66
C11A |  96 60
C11B |  96 60
C11C |  96 60
C11D | 102 66
C11E |  60 3C
C11F |   0  0
```

Top: Part of the BBC micro's bit map. Below: Enlarged letters displayed from the micro's ROM.

until the beep stops. To make this clear, use *FX 214,50 to lengthen the beep.

Ardent users of the COPY key may already have noticed that as you copy various characters off the screen, the operating system puts a copy of what it picked off the screen into section 3,3 for comparison with the characters stored in the operating system ROM at &C000 onwards.

Let's reprogram one of the characters:

VDU 23,65,16,16,16,16,16,16,16,16

This changes the 'A' character to a single vertical line, and it will be seen that all the characters from @ to Z, plus five punctuation marks, appear on the screen from section 10,4 to 11,2 (&C00 to &CFF). If you type in a command such as PRINT ABS(–1), the 'A' appears as a vertical line, but is acted on correctly. Using the COPY key to re-enter the same line will show that it is still interpreted correctly by the operating system as an 'A'.

If you now re-program a different character in another part of the character generator, such as the lower case letter 'a' using:

VDU 23,97,2,2,2,2,2,2,2,2

then that character and its associated characters will replace the upper case letters, and things then become really confused as Basic will appear to be working entirely in lower case characters, and trying to use the COPY key on any upper-case characters left on the screen will result in a bleep since the operating system does not recognise them any more.

Programming any of the function keys shows up in sections 9,5 on to 10,3 (&B00 to &BFF) which is initially filled with space characters. Typing in statements such as:

*KEY 1 ~~~~~~~~~~~~~~

and

*KEY 2 ,,,

will give a clear indication on the screen of what happens as the keys are programmed.

Entering some lines of a dummy program lets you watch Basic doing the editing. Try those lines in the order given:

```
100 ~~~~~~~~~~~~~~~~
10 @@@@@@@@@@@@@@@@
20 JJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJJ
1 //////////////////////////////////////////////
```

and watch the program building up. Then try deleting some of the lines, starting from line 1, and see how Basic shunts the remaining lines up. Then you can try entering NEW and OLD alternately, and perhaps enter a program consisting of a few short lines, and then RENUMBER it.

If you enter a simple FOR ... NEXT loop using a real variable you will be able to see the area above the program being used to store the real variables.

There are lots of other different ideas you can try that demonstrate how the operating system works. If you want, for example, to show how dependent the system is on interrupts, change the interrupt vector IRQ1V using:

!&204 = RND

and see what happens! Almost certainly the 'stack' will suddenly fill up as the system gets tied up in knots.

With a program that uses events, you can illustrate that it forms part of the operating system, and that if corrupted it causes the system to crash. You could use the automatic ADC averaging routines from *Acorn User*, March 1984. If the event is enabled, and you type in:

!&C20 = RND

you will see the effect on the system. What will probably happen is that the stack simply goes round and round in circles.

A routine that has a similar effect is:

```
10 P% = &C00
20 [PHA:PHA:PHA
30 JSR &C00
40 ]
50 CALL &C00
```

There are many more things that could be demonstrated by this method, and it can be used as a diagnostic aid in machine code programs – you can actually 'see' a program working. It is therefore an extremely useful teaching aid for showing just a little bit of how the Electron and BBC micros work.

Next month: We all know how fast the BBC micro works, but how does it look in slow motion.

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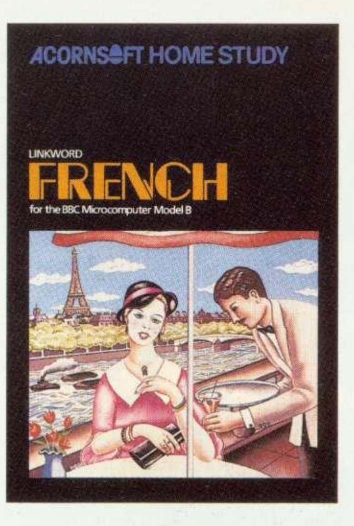
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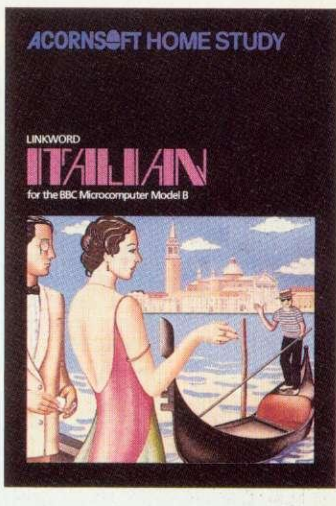
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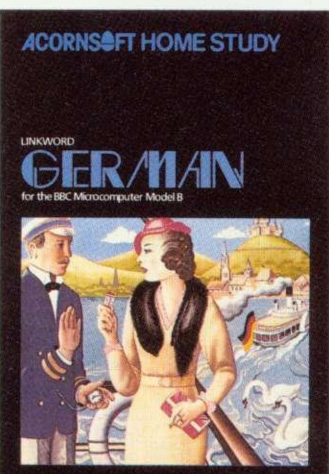
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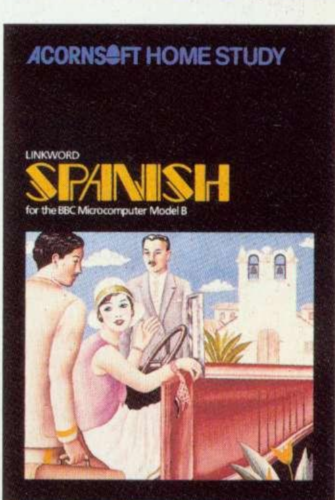
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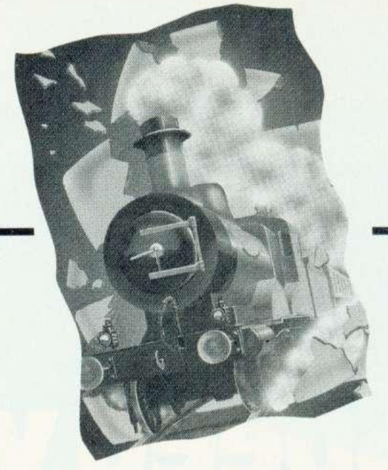
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TRAIN OF THOUGHT

Martin Phillips puts readers on the right track for Train Game

Quite a few letters have been passed on to me concerning the *Train Game* published in the January *Acorn User.* The game and the problems associated with it reflect many of the difficulties of all long games listings, brought about by mistakes in typing, lack of experience in debugging and – unfortunately – problems with the program as printed.

First, let's look at the problems connected with the listing itself.

Most of the trouble occurred in the second part of the program, although there were three faults in part one. Two of the faults were corrected on page 8 of the February issue. The first one concerns disc users only. It is the routine to load the second program from disc and then move it down in memory. Unfortunately the version included in February's *Acorn User* does not work and results in the 'Bad program' error. Use the routine below if this is your problem. (This will also cater for Page differences caused by having Econet or Teletext fitted.)

```
630 *KEY0"LOAD""TRAI
NS2""|M*T.|MF.I%=0 TO
TOP-PAGE S.4:I%!&E00=I
%!PAGE:N.|M?&13=?&13-(
PAGE-&E00)DIV 256|MPAG
E=&E00|MRUN|M"
631 *FX138,0,128
632 END
```

The second correction is included here again and concerns lines 1280 to 1290. This will need to be changed irrespective of whether your machine is tape or disc.

```
1250 DEF PROCSWOP
1260 REM Swop the char set with the
1270 REM user routine space.
1280 FOR I=0 TO &FF
1290 J=I?&C00:I?&C00=I?&900:
I?&900=J
1300 NEXT
1310 ENDPROC
```

The third fault is a minor one. There should be a semi-colon at the end of line 220. It affects only the layout of the screen, not the running of the program.

There are a couple of faults in the second listing. The correct lines are:

```
100 VDU23;8202;0;0;0;
```

This line deletes the cursor. The semi-colon was missing off the end 0 (as it is in most versions of the handbook). This would not stop the program working as a 12 was included after this last 0 and only this command would have been corrupted. VDU12 clears the screen, but this is not necessary as the previous line was a mode change which automatically clears the screen.

Some of the single quote (') signs in the listing should be £ signs, lines 220 and 440 being affected here.

```
220 VDU31,15,0,17,3:
PRINT"FARES: £";P%;" C
OAL: £";C%;"   "

440 PRINTTAB(0,18)"F
ARES :£";P%'"COAL   :£"
;C%'"LOST :£";TC''"PRO
FIT:£";X
```

On my monitor I found the lettering at the top of the screen difficult to read in white, so I changed the colour to blue. This required changes to lines 220 and 1170 where the 3 following the 17 in the VDU statement was changed to a 2.

Line 2510 reads

```
FOR I=8 TO &FF
```

I suspect it should read

```
FOR I=0 TO &FF
```

However, it seems to work either way.

Some lines have been missed out of the listing yet are referred to in GOTOs and GOSUBs. The simple answer here is to check through the program and make a note of any line numbers that appear to be missing. Then check through the listing to confirm that they actually do not exist (I found several lines I'd missed using this method). Rather than altering several GOTOs and GOSUBs it is easier to put each of these lines in. Simply type the missing line number in, and follow it with a colon. For example:

```
140:
340:
480:
```

Now when you list the program, every line should be present.

The next difficulty seems to occur during the scene-drawing when the 'No room' error appears. The program has run out of space to do its calculations or store new variables. The cure is to shorten the program. If you get the 'No room' error first test the length of the second program by typing:

```
PRINT TOP – PAGE
```

You will almost certainly find that the length of this program is more than 6000 bytes. I found the program does not give the error message if the program is under 6000 bytes long. So how do you set about reducing it? The simplest way is to take out as many spaces as possible. This, however, is fraught with problems for the beginner. If you delete only those spaces indicated below you should make the program short enough.

1. Delete the spaces after the line number. They are not necessary.
2. Delete the spaces after a colon, except where the colon appears inside speech marks, as in line 220 above.
3. Delete the spaces between the VDU statement and any number that follows it.
4. Delete the spaces between any GOTO and a number that follows it.
5. Delete the spaces between any GOSUB and a number that follows it.
6. Delete the spaces between the IF statement and whatever follows it.

If you are in any doubt about whether to delete a space or not, leave it in. There is another place where spaces could be deleted. If you have copied several lines, say to correct errors, then it is easy to copy spaces at the end of the line. These cannot be seen but take up memory space. They can be made visible by changing to mode 6, and redefining the space to be a visible character. The space can be changed into a shaded block using the following:

```
VDU23,32,170,85,170,85,170,85,170,85
```

This should be typed in directly, not included as part of the program, and then the program listed. All the extra spaces become visible and can be edited out. By now it should be under 6000 bytes, and it won't run out of memory.

Having done all this, make one more careful check to see that the program has been typed in correctly. Do this by listing sections of about 10 lines at once (LIST10,100 etc) and don't check it all at once. Some mistakes are difficult to spot and a break helps the concentration.

Listing 1.

```
 10 REM Listing 1
 20 TIME = 0
 30 MODE1
 40 VDU29,640;512;
 50 radius=400
 60 FOR T=0 TO 1
 70 MOVE -radius,0
 80 FOR X=-radius TO radius
    STEP 8
 90 Y=SQR(radius*radius-X*X)
100 IF T=1 THEN Y=-Y
110 DRAW X,Y
120 NEXT X
130 NEXT T
140 PRINTTIME/100;"sec"
```

Listing 2.

```
 10 REM Listing 2
 20 TIME = 0
 30 MODE 1
 40 VDU29,640;512;
 50 R%=400
 60 FOR T%=-1 TO 1 STEP 2
 70 MOVE -R%,0
 80 FOR X%=-R% TO R% STEP 8
 90 Y%=T%*(SQR(R%*R%-X%*X%))
100 DRAW X%,Y%
110 NEXT X%
120 NEXT T%
130 PRINTTIME/100;"sec"
```

Listing 3.

```
 10 REM Listing 3
 20 TIME =0
 30 MODE1
 40 VDU29,640;512;
 50 R%=400
 55 S%=R%*R%
 60 FOR T%=-1 TO 1 STEP 2
 70 MOVE -R%,0
 80 FOR X%=-R% TO R% STEP 8
 90 Y%=T%*(SQR(S%-X%*X%))
100 DRAWX%,Y%
110 NEXT X%
120 NEXT T%
130 PRINTTIME/100;"sec"
```

Listing 4.

```
 10 REM Listing 4
 20 TIME = 0
 30 MODE1
 40 VDU29,640;512;
 50 R%=400
 55 S%=R%*R%
 60 FOR T%=-1 TO 1 STEP 2
 70 MOVE -R%,0
 80 FOR X%=-R% TO R% STEP 8
100 DRAW X%,T%*(SQR(S%-X%*X%))
110 NEXT X%
120 NEXT T%
130 PRINT TIME/100;"sec"
```

Listing 5.

```
 10 REM Listing 5
 20 TIME = 0
 30 MODE1
 40 VDU29,640;512;
 50 R%=400
 55 S%=R%*R%
 60 FOR T%=-1 TO 1 STEP 2
 70 M VE -R%,0
 80 FOR X%=-R% TO R% STEP 20
100 DRAW X%,T%*(SQR(S%-X%*X%))
110 NEXT X%
120 NEXT T%
130 PRINT TIME/100;"sec"
```

Listing 6.

```
10 REM listing 6
15 TIME = 0
20 MODE1
30 VDU29,640;512;
40 S%=400
50 MOVE S%,0
60 FOR A=0 TO 2*PI STEP PI/30
70 DRAW S%*COS(A),S%*SIN(A)
80 NEXT A
90 PRINT TIME/100;"sec"
```

Listing 7. As strings are changed, memory runs out

```
10 REM listing 7
20 CLS
30 DIM A$(99)
40 B$="A"
50 FOR T=1 TO 100
60 FOR N=0 TO 99
70 A$(N)=B$
80 NEXT N
90 PRINTTAB(10,10)"WORKING
   T=";T
100 B$=B$+"A"
110 NEXT T
```

Listing 8. The cure

```
10 REM listing 8
20 DIM A$(99)
30 FOR T=0 TO 99
40 A$(T)=STRING$(20,"*")
50 NEXT T
```

Listing 9. Steve Ostler's four-colour dump for the Seikosha GP- 250X

```
32000 REM Listing 9
32010 DEFPROCtonedump
32020 REM Seikosha GP-250X 4-tone dump
32030 REM for modes 1,4 and 5
32040
32050 DIM pattern 3
32060 !pattern=&0F090800
32070 bottom=82:top=bottom+959
32080 VDU2
32090
32100 REM set line feed to 1/8"
32110 VDU1,27,1,76,1,02
32120
32130 FOR X%=0 TO 1279 STEP 32
32140 FOR split%=0 TO 1
32150
32160 REM select graphics mode,
32170 REM &E0 bytes of data
32180 VDU1,27,1,71,1,01,1,&E0
32190 left=16*split%: right=left+15
32200 FOR Y%=bottom TO top STEP 4
32210 byte1=0: byte2=0
32220 FOR x%=right TO left STEP-4
32230 colour=POINT(X%+x%,Y%)
32240 IF colour<0 THEN colour =0
32250 byte1=byte1*4: byte2=byte2*4
32260 byte1=byte1+pattern?colour MOD4
32270 byte2=byte2+pattern?colour DIV4
32280 NEXT
32290 VDU1,byte1,1,byte2
32300 NEXT
32310 NEXT
32320 VDU3
32330 ENDPROC
```

Program 1. Enter as shown

```
  0 REM******************************
     ********
 10 FOR I%=0 TO 3 STEP 3
 20 P%=&1906
 30 [OPT I%
 40 LDA #138
 50 LDX #0
 60 LDY #82
 70 JSR &FFF4
 80 LDY #85
 90 JSR &FFF4
100 LDY #78
110 JSR &FFF4
120 LDY #14
130 DEY
140 JSR &FFF4
150 RTS:]
160 NEXT
170 :
180 REM Auto Run by A Oliver
190 REM Beeb Forum October 1983
200 REM Run this program then type
210 REM       DEL.10,230
220 REM now add lines 10 and 20 of
230 REM listing 2
```

HOW TO PROCEED

Enter program 1 as shown. Ensure that line 0 contains at least 30 asterisks.

Run the program. An assembler listing will be produced. The machine code produced by this listing will now have been assembled within line 0, overwriting most of the asterisks.

If you list the program you'll see that line 0 contains 'garbage'. We need to keep this line, so delete lines 10 to 230 inclusive by typing

DELETE 10,230

Now type in the contents of program 2. The final listing should look like program 3. To be able to run this we need to *SAVE it, and to do this we must know the value of TOP so enter:

PRINT ~TOP

Add 1 to this value and make a note of it.

Now enter:

*SAVE "TAPEDIS" 1900 xxxx 1906

where 1900 is the value of PAGE, xxxx is value of TOP + 1 and &1906 is the assembled address of the machine code as specified by P% in program 1.

Enter listing 4 and save it with:

SAVE "TD"

To auto-run the tape to disc copier you can simply enter

*TAPEDIS

Of course, you could also use CH."TD".

Program 3. Do not type in. This listing merely shows what the result of listings 1 and 2 should be

```
    0 REM*LENTAB(EXTEVALR REMOSCLIEVALU
 REMOSCLIEVALN REMOSCLIEVALSTEP` REMOSCL
 I`********
   10 PAGE=&1100
   20 CHAIN "TD"
```

Program 2. Enter after altering program 1

```
10 PAGE=&1100
20 CHAIN "TD"
```

Program 4. Enter and save as "TD"

```
 10 REM TD
 20 REM OSFILE to transfer from tape to disc
 30 REM (c) Acorn User June 1984
 35 REM by George Hill
 40 MODE7
 50 HIMEM=&1B00
 60 ON ERROR REPORT:PRINT" at line ";ERL:GOTO 250
 70 osfile=&FFDD
 80 DIM name 9
 90 DIM control_block 17
100 control_block?0=name MOD 256
110 control_block?1=name DIV 256
120 X%=control_block MOD 256
130 Y%=control_block DIV 256
140 REPEAT
150 REM Load the file from tape
160 *TAPE
170 *OPT1,2
180 *OPT2,2
190 CLS:PRINT"LOADING FROM TAPE"
200 *LOAD""1B00
210 *DISC
220 PROCsave_file
230 PROCwrite_addresses
240 UNTIL FALSE
250 *TAPE
260 *OPT1,1
270 *OPT2,1
280 *DISC
290 END
300 :
310 DEFPROCsave_file
320 REM Get name and addresses
330 REM A$ is name
332 REM B$ is length
334 REM C$ is load address
336 REM D$ is exec address
340 A$=""
350 FOR I%=0 TO 8:A$=A$+CHR$(I%?&7CC8):NEXT
360 REM Retain directory if present
370 IF MID$(A$,2,1)<>"." THEN A$=LEFT$(A$,7)
380 $name=A$+CHR$13
390 B$=""
400 FOR I%=14 TO 18:B$=B$+CHR$(I%?&7CC8):NEXT
410 C$=""
420 FOR I%=22 TO 30:C$=C$+CHR$(I%?&7CC8):NEXT
430 D$=""
440 FOR I%=31 TO 38:D$=D$+CHR$(I%?&7CC8):NEXT
450 REM Load A register for file saving
460 A%=0
470 REM adjust block for saving
480 FOR I%=2 TO 17:control_block?I%=0:NEXT
490 control_block!&A=&1B00
500 control_block!&E=&1B00+EVAL("&"+B$)
510 CALLosfile
520 ENDPROC
530 :
540 DEFPROCwrite_addresses
550 A%=1
560 control_block!2=EVAL("&"+C$)
570 control_block!6=EVAL("&"+D$)
580 control_block!&A=EVAL("&"+B$)
590 control_block!&E=0
600 CALLosfile
610 ENDPROC
```

See 'Leader of the Pack', page 61

Listing 1. How parts 1 to 6 fit together

```
10 MODE1
15 PROC_design
16 PROC_characters
20 FOR card_positions = 1 TO 6
30 READ x_coord,y_coord
40 PROC_draw_card(x_coord,y_coord,7)
50 NEXT card_positions
60 END
500 DATA 360,55,620,55,880,55,360,375,620,375,880,375
600:
900 REM ****************************
910 REM ** You can use method 1    **
920 REM ** of PROC_print_design    **
930 REM ** instead of method 2,    **
940 REM ** but remember to add     **
950 REM ** line 1065 (which is     **
960 REM ** the same as line 1045   **
970 REM ** for method 2 )          **
980 REM ****************************
990:
1000 DEF PROC_draw_card(x_coord,y_coord,colour)
1010 VDU 24,x_coord;y_coord;x_coord+200;y_coord+290;
1020 GCOL 0,128+colour
1030 CLG
1040 VDU 26
1045 PROC_print_design(x_coord+70,y_coord+170,1)
1050 ENDPROC
1100:
2000 DEF PROC_design
2010 VDU 23,224,170,65,136,20,136,65,160,80
2020 VDU 23,225,170,65,136,20,8,65,130,4
2030 VDU 23,226,170,85,170,85,42,21,10,5
2040 VDU 23,227,168,0,128,0,128,64,160,80
2050 VDU 23,228,2,1,2,85,0,0,0,0
2060 VDU 23,229,168,84,34,81,0,0,0,0
2070 VDU 23,230,128,0,128,0,128,0,128,0
2080 VDU 23,231,128,0,128,0,128,0,0,0
2090 design$ = CHR$224 + CHR$225 + CHR$230 + CHR$8 + CHR$8 + CHR$8 + CHR$10 + C
HR$226 + CHR$227 + CHR$230 + CHR$8 + CHR$8 + CHR$8 + CHR$10 + CHR$228 + CHR$229
+ CHR$231
2100 ENDPROC
2200:
3000 DEF PROC_print_design(x_coord,y_coord,colour)
3010 VDU 5
3020 GCOL 0,colour
3030 MOVE x_coord,y_coord
3040 PRINT design$
3050 MOVE x_coord-10,y_coord+80
3060 DRAW x_coord-30,y_coord+80
3070 DRAW x_coord-30,y_coord+60
3080 MOVE x_coord+80,y_coord-140
3090 DRAW x_coord+100,y_coord-140
3100 DRAW x_coord+100,y_coord-120
3110 ENDPROC
4000:
5900 REM ****************************
5910 REM ** The next procedure is  **
5920 REM ** not used in this       **
5930 REM ** program but is still   **
5940 REM ** included to be added   **
5950 REM ** to any program the     **
5960 REM ** reader decides to      **
5970 REM ** write                  **
5980 REM ****************************
5990:
6000 DEF PROC_characters
6010 VDU 23,232,8,28,28,107,127,107,8,28
6020 VDU 23,233,8,28,62,127,62,28,8,0
6030 VDU 23,234,54,127,127,127,62,28,8,0
6040 VDU 23,235,8,28,62,127,127,127,28,62
6050 club$=CHR$232:diamond$=CHR$233:heart$=CHR$234:spade$=CHR$235
6060 ENDPROC
```

See 'Soft Pottery', page 67

Listing 1

```
 10 MODE1
 20 M%=2200:VZ%=-3000:VY%=850
 30 DIM Profile%(40),LX%(40),LY%(40),LZ%(40)
 40 REPEAT
 50   CLS
 60   REPEAT
 70     INPUT TAB(3,6)"function ",F$
 80     UNTIL F$<>""
 90   CLS
100   MOVE640,0:PLOT21,640,1023
110   FOR V%=0 TO 40
120     Profile%(V%)=EVAL(F$)
130     IF V%=0 K%=4 ELSE K%=5
140     PLOTK%,640+EVAL(F$),100+V%*20
150     NEXT
160   PRINT TAB(3,8)"continue ? ";
170   A$=GET$
180   UNTIL A$="Y" OR A$="y"
190 CLS
200 REPEAT
210   INPUT TAB(3,4)"pattern ",P$
220   UNTIL P$<>""
230 INPUT TAB(3,6)"X angle ",AX
240 INPUT TAB(3,8)"Z angle ",AZ
250 CLS
260 VDU29,640;1200;
270 VDU19,1,4;0;19,2,6;0;19,3,7;0;
280 FOR S%=-1 TO 1 STEP2
290   FOR H%=0 TO 180 STEP 5
300     AY=90+S%*H%
310     FOR V%=0 TO 40
320       PROCrotateY(Profile%(V%),25*V%-500,0,AY)
330       IF AZ<>0 PROCrotateZ(x%,y%,z%,AZ)
340       IF AX<>0 PROCrotateX(x%,y%,z%,AX)
350       PROCplot(4,x%,y%,z%)
360       IF V%>0 AND H%>0 PROCfacet
370       IF V%=40 GCOL0,0:PROCplot(5,x%,y%,z%)
380       TX%=LX%(V%):TY%=LY%(V%):TZ%=LZ%(V%)
390       LX%(V%)=x%:LY%(V%)=y%:LZ%(V%)=z%
400       PROCplot(4,x%,y%,z%)
410       NEXT
420     NEXT
430   NEXT
440 END
450 :
460 DEFPROCplot(K%,X%,Y%,Z%)
470 M=M%/(Z%-VZ%)
480 PLOTK%,X%*M,(Y%-VY%)*M
490 ENDPROC
500 :
510 DEF PROCfacet
520 GCOL0,EVAL(P$)
530 PROCplot(85,TX%,TY%,TZ%)
540 PROCplot(85,LX%(V%),LY%(V%),LZ%(V%))
550 ENDPROC
560 :
570 DEF PROCrotateY(X%,Y%,Z%,A)
580 S=SINRADA:C=COSRADA
590 x%=X%*C-Z%*S
600 z%=Z%*C+X%*S
610 y%=Y%
620 ENDPROC
630 :
640 DEF PROCrotateX(X%,Y%,Z%,A)
650 S=SINRADA:C=COSRADA
660 y%=Y%*C-Z%*S
670 z%=Z%*C+Y%*S
680 x%=X%
690 ENDPROC
700 :
710 DEF PROCrotateZ(X%,Y%,Z%,A)
720 S=SINRADA:C=COSRADA
730 x%=X%*C-Y%*S
740 y%=Y%*C+X%*S
750 z%=Z%
760 ENDPROC
```

Listing 2

```
 10 MODE4
 20 VDU29,640;1200;
 30 M%=2200:VZ%=-3000:VY%=850
 40 DIMProfile%(40),LX%(40),LY%(40),LZ%(40)
 50 REPEAT CLS
 60   INPUT TAB(1,4)"Function ",F$
 70   UNTIL F$<>""
 80 INPUT TAB(1,6)"X rotation ",AX
 90 INPUT TAB(1,8)"Z rotation ",AZ
100 CLS
110 FOR V%=0 TO 10
120   Profile%(V%)=EVAL(F$)
130   NEXT
140 FOR H%=0 TO 10
150   AY=H%*36
160   FOR V%=0 TO 10
170     PROCrotateY(Profile%(V%),100*V%-500,0,AY)
180     IF AZ<>0 PROCrotateZ(x%,y%,z%,AZ)
190     IF AX<>0 PROCrotateX(x%,y%,z%,AX)
200     IF V%=0 K%=4 ELSE K%=5
210     PROCplot(K%,x%,y%,z%)
220     IF H%>0 PROCplot(5,LX%(V%),LY%(V%),LZ%(V%))
230     LX%(V%)=x%:LY%(V%)=y%:LZ%(V%)=z%
240     PROCplot(4,x%,y%,z%)
250     NEXT
260   NEXT
270 END
280 :
290 DEFPROCplot(K%,X%,Y%,Z%)
300 M=M%/(Z%-VZ%)
310 PLOTK%,X%*M,(Y%-VY%)*M
320 ENDPROC
330 :
340 DEF PROCrotateY(X%,Y%,Z%,A)
350 S=SINRADA:C=COSRADA
360 x%=X%*C-Z%*S
370 z%=Z%*C+X%*S
380 y%=Y%
390 ENDPROC
400 :
410 DEF PROCrotateX(X%,Y%,Z%,A)
420 S=SINRADA:C=COSRADA
430 y%=Y%*C-Z%*S
440 z%=Z%*C+Y%*S
450 x%=X%
460 ENDPROC
470 :
480 DEF PROCrotateZ(X%,Y%,Z%,A)
490 S=SINRADA:C=COSRADA
500 x%=X%*C-Y%*S
510 y%=Y%*C+X%*S
520 z%=Z%
530 ENDPROC
```

V

TAPE LOADER

See 'Rapid Retrieval Taped', page 81

Listing 1. 'Loader', an accurate and rapid search and load routine for tapes

```
   10 REM ** Initialisation **
   20
   30 *TV 255
   40 MODE7
   50 LOMEM=TOP+&80
   60 DIM COM% 30:cli%=&FFF7
   70
   80 *KEY10 OLD|MRUN|M
   90
  250 PRINT'''"    1.   LOAD"''"or  2.
 SAVE"
  260 ?216=32:PRINT''"Choose a number (1
 or 2)"
  270 ON INSTR("12",GET$) GOTO600,280 EL
SE 270
  280 IF PAGE=&E00 THEN PRINTCHR$12;''"T
he program to be SAVED must be entered b
efore this LOADER program."''"Please st
art again if you wish to SAVE.":END
  290 CLS:INPUT''"What is the name of th
e program?"'PROGRAM$:PROCSAVE(PROGRAM$):
PROCDATA(PROGRAM$):END
  300
  310 DEF PROCSAVE(PROGRAM$):CLS
  320 TP%=(TOP-1):R%=FNC(TP%)
  330 RESTORE (1000+R%):READ A$,S%,R%
  340 PROCREW
  350 PRINT''"Check that the tape counte
r is zeroed."''"Ready?":PROCYES
  360 PROCFF
  370 CLS:PRINT''"Winding on .... Please
 wait.":TIME=0:*MOTOR 1
  380 REPEAT:UNTIL TIME>S%:*MOTOR 0
  390 CLS:PRINT CHR$7''"Press STOP"''"Is
 it ready?":PROCYES
  400 CLS:PROCcli("SAVE"""+PROGRAM$+""""
+"E00 "+STR$~(PAGE-1)):ENDPROC
  410
  420 REM **Procedure to record fast-
 forward times **
  430
  440 DEF PROCDATA(PROGRAM$)
  450 CLS:PRINT''"Carefully note the tap
e counter reading."''"Ready?":PROCYES
  460 PROCREW:PROCFF
  470 PRINT''"When the tape counter show
s the end of"'"the program has been reac
hed press"'"ANY KEY to stop."
  480 R%=FNC(TP%)
  490 R%=R%+1:TIME=0:*MOTOR 1
  500 G$=GET$:T%=TIME:N$=" "+PROGRAM$+",
 "+STR$(T%)+","+STR$(R%):*MOTOR 0
  510 N1=(1000+R%)DIV 256:N2=(1000+R%)MO
D 256
  520D=LEN(N$)+5:P$=CHR$N1+CHR$N2+CHR$D+
CHR$220+N$+CHR$13+CHR$255:$(TP%)=P$:PROC
REW:PROCFF
  530 CLS:PRINT''"Winding on .... Please
 wait."
  540 TIME=0:*MOTOR 1
  550 REPEAT:UNTIL TIME>50:*MOTOR 0
  560 CLS:PRINT CHR$7''"Press STOP"''"Is
 it ready?":PROCYES
  570CLS:Loader$="Loader":PROCcli("SAVE"
""+Loader$+""""+STR$~(PAGE)+" "+STR$~(TO
P+LEN(P$)-1))
  580 ENDPROC
  590
  600 PROCLOAD:END
  610
  620 DEF PROCLOAD
  630 RESTORE 1002:CT%=-1:CLS:PRINT''"Pr
ograms on this tape are:-"'':TP%=5110:RE
PEAT:TP%=TP%+1:UNTIL?TP%=255:L%=FNC(TP%)
  640 CT%=CT%+1
  650 FORN%=1 TO 5:READ A$,S%,R%
  660 PRINTN%;"   ";A$':IF R%=L% THEN N%=
6:PRINT''TAB(25)"...That's all."
  670 NEXT:PRINT''"Type the number of yo
ur choice"''"or press the SPACE BAR."
  680 G$=GET$:IF G$=" " THEN GOTO790 ELS
E G%=VAL(G$)+5*CT%
  690 IF VAL(G$)>5 OR VAL(G$)=0 OR G%>L%
-1 THEN PRINTTAB(0,23)CHR$136;"Choose on
e of the numbers please!":GOTO680
  700 RESTORE(1000+G%):READ A$,S%,R%
  710 PROCREW:PROCFF:CLS:PRINT''"Winding
 on .... Please wait.":TIME=0:*MOTOR 1
  720 REPEAT:UNTIL TIME>S%:*MOTOR 0
  730 CLS:PRINT CHR$7''"Does this progra
m need the maximum"'"memory available?"
  740 IF GET$="Y" CLS ELSE 760
  750PRINT''CHR$136"THIS WILL WIPE OUT L
oader"''" Do wish to continue?":IF GET$=
"Y" GOTO770 ELSE CLS:PRINT''"Press KEY f
0 to try again.":G%=GET
  760 PAGE=TOP+&100
  770 CLS:PRINT''"Press PLAY."''"Is it r
eady?"':IF GET$<>"Y" THEN 770
  780 CLS:CHAIN"":ENDPROC
  790 CLS:IF R%<L% THEN GOTO640 ELSE PRI
NT''"There are no more on this tape."''"
Do you want to try again?":IF GET$="Y" T
HEN GOTO630
  800 CLS:PRINT''"Try another tape.":END
PROC
  810
  820 DEF PROCREW: REM ** Rewind **
  830 CLS:PRINT''"Press the rewind key."
''"Is it ready?":PROCYES
  840 *MOTOR1
  850 CLS:PRINT''"Is it fully rewound?":
PROCYES:*MOTOR 0
  860 ENDPROC
  870 DEF PROCFF: REM ** Fast Forward **
  880 CLS:PRINT''"Press the FAST FORWARD
 key."''"Is it ready?":PROCYES
  890 ENDPROC
  900
  910 DEFPROCYES
  920 IF INSTR("Yy",GET$)>=1 ENDPROC ELS
E 920
  930
  940 DEFFNC(TP%)
  950 L$=$(TP%-3):IF VAL(LEFT$(L$,1))=0
THEN =VAL(RIGHT$(L$,1)) ELSE =VAL(L$)
  960
  970 DEFPROCcli(cl$)
  980 $COM%=cl$:X%=COM%:Y%=COM% DIV 256
  990 CALL cli%:ENDPROC
 1000
 1001 DATA LOADER,1100,1
```

Listing 2. Patch to cure bugs in the OS 0.1 CFS

```
   80 *KEY 10 ?&218=&D0:?&219=&D:?&20A=&
D6:?&20B=&D|MOLD|MRUN|M
   90
  100 REM ** O.S.version 0.1 Patch **
  110 FORI%=0 TO 1:P%=&DD0
  120   [OPTI%*2
  130   .FIX1 PHA:JSR &F521:PLA:RTS
  140   .FIX2 CMP#&91:BNE GO:CPX#0:BNE G
O
  150   TSX:LDA&102,X:CMP#&F7:BEQ TRAP
  160   LDX#0:.TX LDA#&91:STA&FE09:RTS
  170   .GO JMP(&DB60)
  180   .TRAP PLA:PLA
  190   JSR&F9D8:JSR&FB7B
  200   JSR TX:JMP&F7FB
  210   ]NEXT
  220 ?&218=FIX1:?&219=FIX1 DIV 256
  230 ?&20A=FIX2:?&20B=FIX2 DIV 256
```

Listing 1. Shows how the characters are formed on the screen

```
 10 MODE6
 20 VDU19;4;0;        Background colour blue
 30 M%=&6DC0          Somewhere in middle of screen
 40 N%=&C080          Character generator in rom
 50 REPEAT
 60 A=GET             Wait for a key to be pressed
 70 ?M%=?N%           Poke another byte into screen ram
 80 M%=M%+1
 90 N%=N%+1
100 UNTIL A=13        Escape if return key pressed
```

Listing 2. Displays the character generator in large block form

```
 10 MODE6
 20 PROCinit
 30 FORM%=&C000 TO &C2FF
 40 PROCbyte(M%)
 50 NEXT
 60 END
 70
 80 DEFPROCbyte(M%)
 90 LOCAL T%,H%
100 @%=6
110 T%=128
120 PRINT~M%,CHR$253;
130 FOR H%=0 TO 7
140 IF(?M% AND T%)>0 THEN



150 T%=T%/2
160 NEXT
170 @%=3
180 PRINTCHR$254,?M%,~?M%
190 ENDPROC
200
210 DEFPROCinit
220 LOCAL N
230 VDU19;4;0;23;10,32,0;0;0;
240 N=1
250 VDU23,253,N,N,N,N,N,N,N,N
260 N=128
270 VDU23,254,N,N,N,N,N,N,N,N
280 N=126
290 VDU23,255,0,N,N,N,N,N,0,0
300 ENDPROC
```

Listing 4. Displays a bit representation

```
 10 BITS%=16
 20 *FX16,4
 30 MODE6
 40 PROCinit
 50 REPEAT
 60 VDU30
 70 FOR N%=1TO4
 80 REPEAT
 90 UNTIL ADVAL(0)DIV256=N%
100 PROCdisplay(ADVAL(N%))
110 NEXT
120 PRINT" 1234567891111111"
130 PRINT"          0123456"
140 UNTIL 0
150 END
160
170 DEFPROCdisplay(M%)
180 T%=&8000
190 PRINTCHR$253;
200 FOR H%=1 TO BITS%
210 IF(M% AND T%) VDU255 ELSE VDU32
220 T%=T%/2
230 NEXT
240 PRINTCHR$254
250 ENDPROC
260
270 DEFPROCinit
280 LOCAL N
290 VDU19;4;0;23;10,32,0;0;0;
300 N=1
310 VDU23,253,N,N,N,N,N,N,N,N
320 N=128
330 VDU23,254,N,N,N,N,N,N,N,N
340 N=126
350 VDU23,255,0,N,N,N,N,N,0,0
360 ENDPROC
```

Listing 3. Displays the bit map and produces a text window on the screen

```
 10 MODE 6
 20 VDU19;4;0;                 Blue background
 30 VDU23;12;0;0;0;            Make video ram start at page zero
 40 ?&34E=0                    Tell O.S. to use pages zero onwards
 50 VDU 12                     Clear screen
 60 VDU 28,0,24,39,14,12       Define a text window to avoid scrolling
 70 ?&E00=13:?&E01=255         Prepare to enter a program at &E00
 80 FOR I%=&E02 TO &1000       Clear the space
 90 ?I%=0
100 NEXT
110 PAGE=&E00                  Change PAGE
```

VII

See 'Screen Test', page 134

Test match: this program puts a monitor through various trials detailed in the main text. See panel for a star rating of each monitor under review for tests A to I

```
   10  REM VARIOUS MONITOR TESTS
   20  REM ******* MENU ********
   30  MODE 7
   40  *FX11,0
   50  *FX15,0
   60  FORV=1TO2:PRINTTAB(5,V)CHR$141CHR
$132CHR$157SPC(3)CHR$134CHR$157CHR$132"M
onitor Tests "CHR$157SPC(4)CHR$156:NEXT
   70  FORW=4 TO 5:PRINTTAB(6,W)CHR$134;
CHR$157;CHR$141;CHR$132,"  MENU";SPC11;C
HR$156:NEXT
   80 PRINT''TAB(5)"A... Random lower ca
se letters":PRINTTAB(5)"B... Inverse M's
 and W's.":PRINTTAB(5)"C... Flashing B/W
."
   90 PRINTTAB(5)"D... Alternating bars.
":PRINTTAB(5)"E... Border line.":PRINTTA
B(5)"F... Circles."
  100  PRINTTAB(5)"G... Horizontal colou
r stripes.":PRINTTAB(5)"H... Flashing te
xt.":PRINTTAB(5)"I... Colour test."
  110  PRINTTAB(5)"Z...";CHR$131;"END PR
OGRAM":PRINT''''TAB(10)"ENTER your choic
e.";
  120 ONINSTR("ABCDEFGHIZ",GET$)GOTO 170
,260,370,470,580,630,710,810,920,130 ELS
E VDU7:GOTO120
  130  MODE 7
  140  END
  150  REM ***** THE TESTS ******
  160  REM * Random lower case letters *
  170  MODE 0
  180  CLS
  190  FOR N%=1 TO 2560
  200  C=RND(26)
  210  VDU C+96;
  220  NEXT N%
  230  REPEAT UNTIL GET=32
  240  GOTO30
  250  REM * Alternating inverse M's and
 W's *
  260 VDU23,240,156,156,148,148,128,136,
156,255
  270 VDU23,241,255,156,136,128,148,148,
156,156
  280 CLS
  290 MODE 0
  300 FOR Z%=1 TO 16
  310 FOR Y%=1 TO 40:VDU240,241;:NEXT Y%
  320 FOR X%=1 TO 40:VDU87,77;:NEXT X%
  330 NEXT Z%
  340 REPEATUNTIL GET=32
  350  GOTO30
  360  REM * Flashing B/W screen *
  370 CLS
  380 MODE 0
  390 FOR T%=1 TO 15
  400 VDU19,2,0;0;
  410 FORdelay=1 TO 1000: NEXT
  420 VDU19,2,7;0;
  430 FORdelay=1 TO 1000:NEXT
  440 NEXT T%
  450 GOTO 30
  460  REM * White bars test *
  470 MODE 0
  480 VDU23,240,255,255,255,255,255,255,
255,255
  490 FOR Z%=1 TO 16
  500 FOR C%=1 TO 40
  510 VDU240
  520  NEXTC%
  530 PRINT:PRINT
  540 NEXTZ%
  550  REPEAT UNTIL GET=32
  560  GOTO30
  570  REM * Screen border *
  580  MODE 0
  590 MOVE2,2:DRAW1277,2:DRAW1277,1021:D
RAW2,1021:DRAW2,2
  600 REPEAT UNTIL GET=32
  610 GOTO30
  620  REM * Solid circle *
  630 MODE 0
  640 MOVE 740,512
  650 FOR C=0 TO PI+PI STEP0.01
  660 DRAW640+100*COS(C),512+100*SIN(C)
  670 DRAW640+500*COS(C),512+500*SIN(C)
  680 NEXT C
  690 REPEAT UNTILGET=32
  700 GOTO30
  710  REM * Horizontal bands of colour
*
  720 MODE 2
  730 FOR I%=0 TO 1023 STEP4
  740 GCOL0,(I%/4 MOD8)
  750 MOVE 0,I%
  760 DRAW1279,I%
  770 NEXT I%
  780 REPEAT UNTIL GET=32
  790 GOTO30
  800  REM * Persistence test *
  810 MODE 1
  820 *FX9,60
  830 *FX10,70
  840 VDU19,3,15;0;
  850 FOR X%=1 TO 10
  860 PRINT"A TEST FOR PERSISTENCE."
  870 PRINT:PRINT
  880 NEXT X%
  890 REPEAT UNTIL GET=32
  900 GOTO 30
  910  REM * Colour test *
  920  MODE7
  930  H%=5
  940  FOR Y%=2 TO 20
  950  FOR I%=1 TO 7
  960  B$=STRING$(3,CHR$(&90+I%)+STRING$
(4,CHR$(255))+CHR$(10)+STRING$(5,CHR$(8)
))
  970  PRINTTAB(H%*I%-3,Y%)B$
  980  NEXTI%
  990  NEXTY%
 1000  PRINTTAB(0,1);"  RED GRN YEL
BLU MAG CYN WHT"
 1010  REPEAT UNTIL GET=32
 1020  GOTO30
```

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AU6/2

Due to a misunderstanding entirely unconnected with Viglen and circumstances beyond Viglen's control incorrect details appeared in the previous issue. Viglen sincerely hope that this time the information in this advert is correct and looking forward to receiving your orders.

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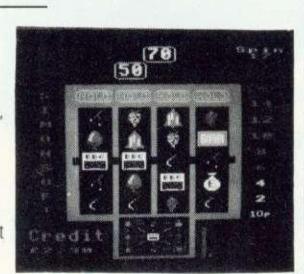
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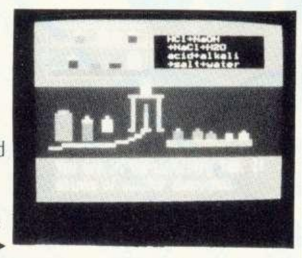
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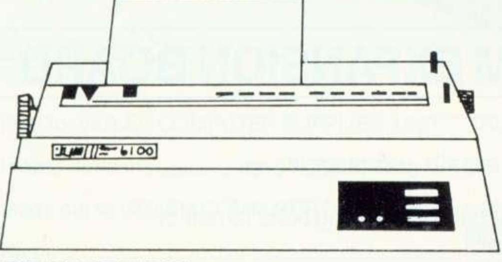
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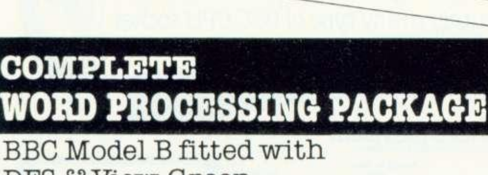
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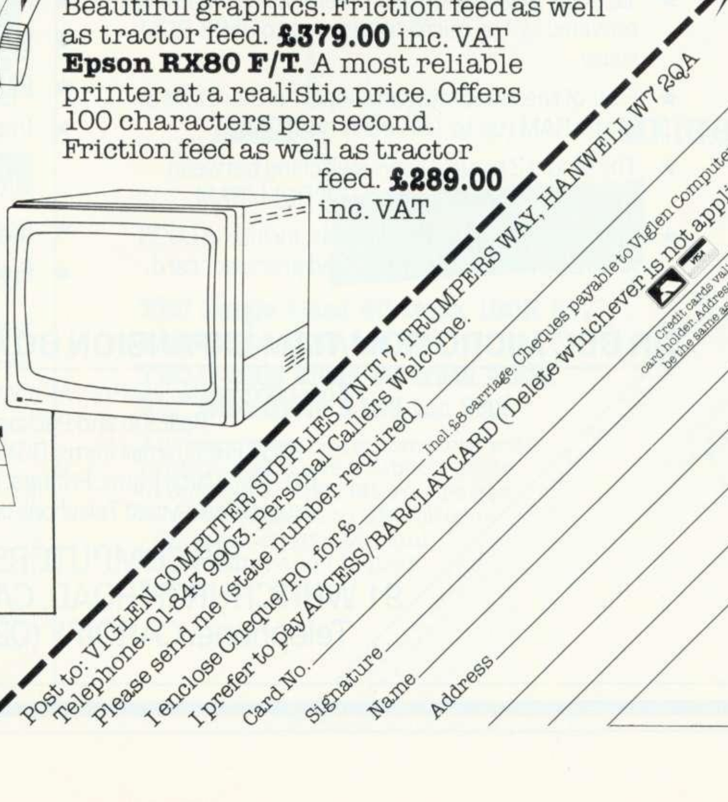
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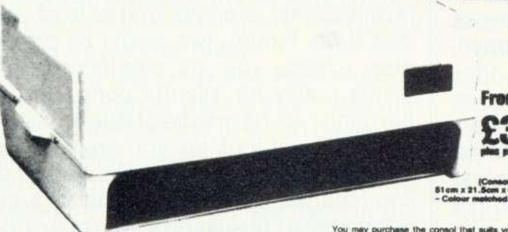
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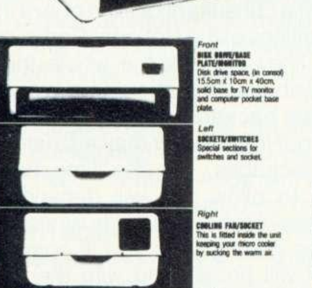


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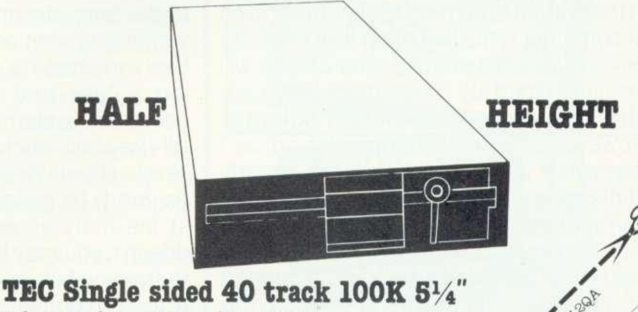
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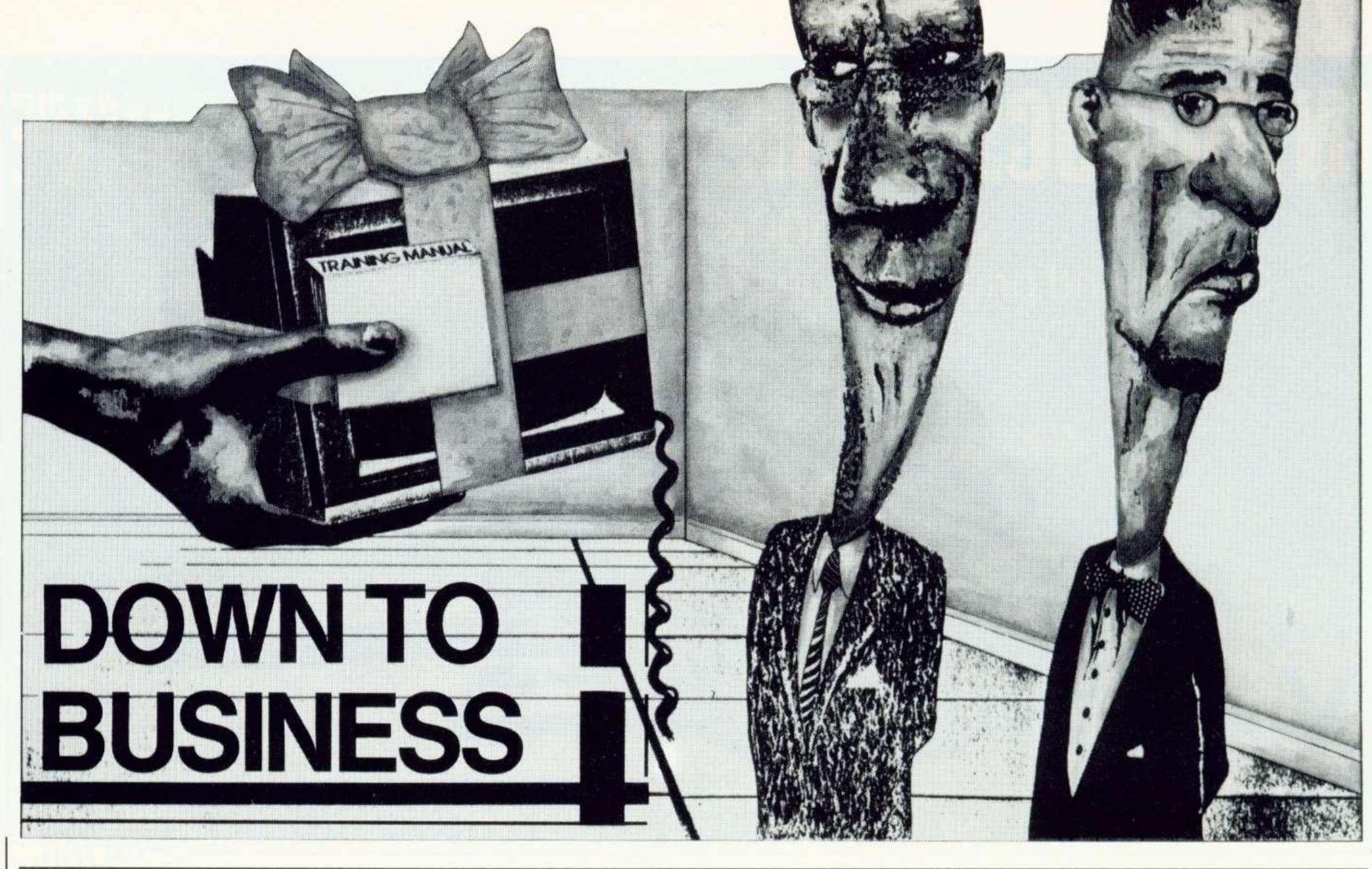


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AU 5/4



Should you computerise?

Barry Pickles talks you through the early decisions

SO YOU'RE thinking of using a computer for your business? Before you commit yourself, you need to answer five basic questions:

1. Do I really need a computer?
2. What will it/they be used for?
3. How will it affect current working practices?
4. Which software packages most readily fit my needs?
5. Which computer should I use?

In the normal scheme of things, the choice of computer is the last thing that needs to be considered, because your choice will be determined by those machines capable of running your chosen software. However, as you are reading this article, I can safely assume that you are already thinking in terms of the BBC micro; perhaps you have one at home and are looking for suitable ways in which it can help your business. But let's not get ahead of ourselves. The first thing you need to decide is whether a computer can help you at all.

The answer is almost invariably 'Yes'. Microcomputers are useful to a businessman in many ways. Two obvious applications are word processing and financial planning/modelling and, if you look through our back issues, you will find reviews of various such packages available. I would also recommend that you read the articles 'Busi-Beeb' and 'Down to Work' in *Acorn User*, September 1982.*

Whether you can use a computer in more complex ways depends upon your particular situation. Just because you use a computer, it doesn't mean that your work will be done more efficiently or cost-effectively. With the advent of the Z80 second processor, much more business applications software should become available through the use of the C/PM operating system – however, as with Basic, there is no such thing as a standard implementation.

Unless you are a sole trader – and particularly if you have little experience of computers – you must consider the effect that a computer may have on your current working system and on your employees. Everyone has his own way of approaching a task and the introduction of a computer system, especially one using off-the-shelf packages, can come as a severe shock. Ideally, the software should, as nearly as possible, approach the task in the manner you use at present. If it doesn't, you may be faced with expensive re-training bills or even the possibility that a loyal member of staff will leave you because of his or her inability to work with the system. At best, some retraining will be involved. Also, you will have to enter your existing files into the system, which in itself can be a severe headache.

The choice of software will be limited by what is available for your system and what best suits your working arrangements. The choice of computer is already assumed. As it happens, the BBC micro can be of considerable help, thanks to its sheer versatility and expandability. The minimal system you will need will comprise a monitor (TVs are not good enough for business use), a printer and at least one disc drive, though two would be preferable. (Unless you are preparing documents purely for internal consumption, the printer will have to be of letter quality.)

Having got thus far, you are ready to begin final planning. It is at this stage that you should seek professional advice, either from a consultant or from one of the regional offices of the National Computer Centre†. They will talk the whole thing through with you and should have some appropriate packages for you to look at and try. Your local dealer may also let you try out packages, but the time he is prepared to allow you will depend, in many cases, on how much business he anticipates getting from you. If some of your staff will be working with the final implementation, it is a good idea to involve them at this stage. Their views are likely to be less euphoric than yours and they will feel much happier about the whole scheme if they have been involved in its conception.

You may benefit from taking a short

*Back numbers of *Acorn User* are available from the Subscriptions Dept, Redwood Publishing, 68 Long Acre, London WC2E 9JH, price £1.25 inclusive.

† Currently the only professional body for computer people in the UK is the British Computer Society. While membership is no guarantee, it does imply a certain standard. The BCS will put you in touch with a local consultant member. The address is 13 Mansfield Street, London W1M 0BP (01-637 0471). The National Computing Centre has a network of regional centres, where you can seek advice. These centres have workshops in which you may try out various packages. Initial contact is free of charge. The NCC is at: Oxford Road, Manchester 1 (tel: Freephone 3615).

course in business computing. A number are usually advertised in the computer press, but you may well find that your local adult education authority runs courses locally. You will learn some of the things to avoid and gain hands-on experience.

Before rushing out with your cheque-book, plan the conversion process carefully. Write down all the stages that you will have to go through and set yourself rough targets. It is unlikely that you will be able to meet them, but it gives you something to measure your progress by.

When you come to purchase the equipment, don't forget maintenance. Computers, and especially their peripherals, can go wrong, so consider the effect of this on your workflow. Mainframe installations usually have engineers on call 24 hours a day but you are unlikely to find this level of service on a micro and, if you do, it will not come cheap; sort this out with your dealer at the time of purchase. Implement the system in stages, the simpler applications first, and thoroughly test each application before you commit yourself irrevocably. If possible run the manual system in tandem for a while. A good starting point is to set up a word processing system to help you get used to handling discs, controlling a printer and generally organising a 'work station'.

Finally, here are two golden rules, lessons learned from almost 20 years' experience in using computers in business:

- COMPUTERS BREAK DOWN. Usually, at the most inconvenient time. Try not to put yourself in a situation where you are totally dependent upon the machine to carry out your business activities.
- PERIPHERALS DO GO WRONG. Make it a rule that every day you will make back-up copies of all the files used that day. That way, you will have only lost one day's work if something goes wrong. Back-ups should be stored elsewhere from your normal place of work, in case of fire.
- PEOPLE ARE HUMAN BEINGS. And they don't like their normal routines being mucked about with! Considering the versatility of computers, I am amazed by the number of systems which require staff drastically to revise their working methods to fit in with The Computer. Involve staff and try to keep changes to a minimum.

OK, so that's three rules, but then things never turn out quite as you expected. Computerising a business is a serious matter, requiring careful thought.

VIRTUES OF SIMPLICITY

Barry Pickles compares the invoicing and mailing list packages published by Acornsoft and Gemini

'Invoicing' and 'Mailing List', Acornsoft, £24.95 each.
'Invoicing & Statements' and 'Mailing List', Gemini, £23.85 each.

THE two pairs of packages reviewed here from Acornsoft and Gemini are each part of a whole suite of packages produced by these houses, designed to cover the 'paperwork' tasks that most small businessmen find onerous. The Acornsoft packs form an integrated package; that is, data created by one can be used by others. The Gemini packs are not integrated.

Turning first to the Acornsoft pack for *Invoicing,* this comes in a smart case with manual, the first half of which deals with the handling procedures for data files and is common to all the other manuals. The second half covers the package in use and gives adequate information, but it is not the most comprehensive documentation I have encountered. All packs are on 40-track, single-sided disc only (although it doesn't say this anywhere in the packaging) and if you use 80-track you need to write to Acornsoft to find out how to adapt the pack (Acornsoft says it wasn't possible to do the 40/80-readable discs because of lack of space on the disc). Each pack also requires its own data disc (or two, if you are sensible and back-up everything).

The disc auto-boots and you then have to set up system parameters. This means telling the system whether you are using single or twin drives and what other packages you have from the same series. If this is the first use of the system you create a data disc, following the prompts. Here is the first hurdle, for the disc is first referred to as the Data disc but is subsequently called by a different name (which depends upon which pack you are using). This leads you to suppose, incorrectly, that it refers to a different disc and, if you are using a twin drive system, you will not have even removed the Data disc!

Now you move on to creating the various files your system will need. The files are created with a fixed record length, and space is reserved on the disc by creating a dummy file, which is subsequently overwritten by real data. This requires you to guess how many records you'll need and you are advised to err on the low side, since a large file cannot be made smaller, but a small file can be made bigger (more of this anon).

You are presented with the record screen for you to input the required data. Most fields are mandatory and some will accept only numeric data. There is full error-checking, so you can't get it wrong. The first thing you notice is that the address field is limited to three lines. The second thing is that, if you make a typing mistake and you have already pressed Return, you are given the option at the end of each screen to proceed or not. Taking the latter course, the entire record is wiped out and you must do the whole thing again. This is particularly disconcerting at the end of the second screen, since *both* screens are erased!

You may encounter another quirk with the optional field for the (customer's)





purchase order number. If you ignore it and just press Return, all is well; but if you input some data, pressing Return returns you to the menu screen and – yes, you've

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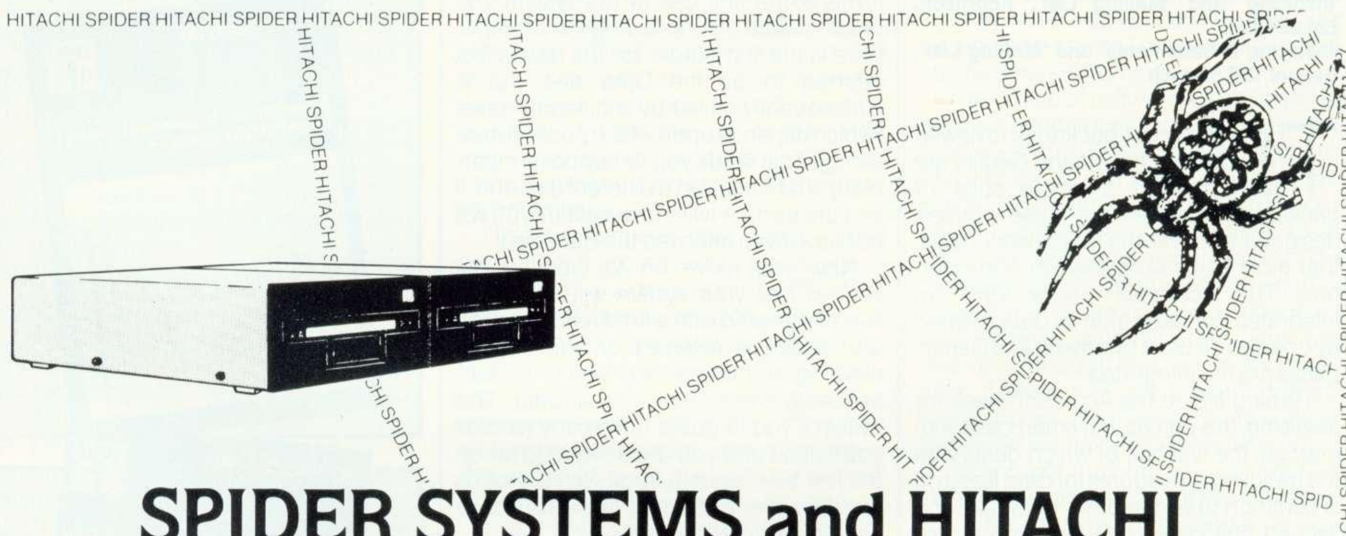
A superb joystick and a keypad for the price of either one. Plus the software to integrate it into the computer's system.

One handset will work on it's own in the A/D port as a joystick and two fire buttons. Joystick is immediately compatible with ACORNSOFT and similar software.

The interface joins together the analogue and the user ports to use the full keypads giving a total of 24 user definable keys. The interface can also be used as a splitter for the A/D port to take two items at the same time, e.g. joystick and lightpen.

DELTA DRIVER on cassette or disc: Two programs on each cassette or disc. One converts machine code programs from the keyboard to the joystick or keypad, with adjustable sensitivity on the joystick and will run on any O.S. The second program (needs O.S. 1.0 or later and an interface) duplicates any keyboard keys on the keypads, in the operating system, so that it can become a numeric keypad or will take on the function keys.





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guessed it – the entire record is wiped out! One way round this is to save the file with any mistakes, load it back in and then use the AMEND function provided, which gives line-by-line editing. But why not do this as the data is inserted?

From here, you next set up your VAT classifications, five in all. This is straightforward, but I would have liked to have an E (for exempt) class, rather than purely numeric fields.

Now you are ready to produce an invoice. You have the option to preview any invoice in 80-column mode, without printing. However, you find that to do this you need to copy a file from the program disc to the data disc. To be fair, the manual tells you this, but why it wasn't automatically copied at the system set-up stage I do not understand. If you've forgotten to do it, you must quit the program, copy the file, then re-enter and work your way down through the various levels.

The program is modular and there are various levels – pressing Escape returns you to the menu or the next highest level.

Print out your invoice(s) – and here is your next shock. The invoice layout is fixed and the print type is that of the default setting of your printer. A sample invoice is shown in figure 1 and you will see from this that, as well as being restricted to A4 format, any pre-printed stationery you have cannot be used. Even worse, the company name header is not even properly centred.

Having accepted the foregoing, you will sooner or later want to make your files larger. To do this, you select the EXTEND option and follow the prompts. Again, the error-checking is first-rate and you cannot inadvertently insert the wrong disc. However, when we tested it, it required no fewer than 24 disc changes to accomplish. This was using only two of the possible seven packs and on a twin-drive system. How often you will have to do this depends on your business, but it takes ages and a lot of clicking and clunking on the disc drives.

Most of what I've said so far also applies to the *Mailing List* program (and, presumably, the rest of the series). It is simpler to use, with options to have a selective mailing, based on four classification types. Again, however, there is no print-style option and no formatting. Neither can you use labels set across the page, since it prints them only vertically. You are permitted only one copy of each label (unless you return to the menu each time) and they are automatically printed in supplier number order – and will continue printing until you get to the end of the file or press Escape. It is a simple pack, the kind of program that could be written by any competent ten-year-old and does not justify its price, apart from its ability to interact with other packs.

By the way, none of these packs works with the Watford DFS.

After all this, turning to the Gemini packs came as something of a relief! The packs come in a less flashy package, again with a manual. They are compatible with the Watford DFS and can be supplied in 40 or 80-track format.

The manuals are clear but are hardly needed since there are prompts galore. In fact, the first time I used it, I didn't refer to the manual yet managed to produce a document within five minutes.

Because these packs are not integrated you'll need to recreate data for each one that you use. However, they are written at a much simpler level, and perhaps because of this, do their job much more satisfactorily. There are various options. The *Invoices & Statements* pack allows: Print or Report; Statements or Invoices (you need a separate pack to produce statements with the Acornsoft system); Inspect files; Save; Add footer message(s). This last option puts messages (rude or otherwise) at the foot of the invoice. Again, the invoice format is fixed, but you have print options.

The *Mailing List* pack options are: Add record; Alter record (no bugs here!); Sort; Browse (exactly that, backwards or forwards); Find; Delete; Save; Print. Again, there are some print options allowing use of multi-header labels and you specify how many of each you want to print and where printing is to start and stop. There is no limit to the number of lines you may have. Again, screen prompts abound and it's simple enough for a child to use.

The integration technique provided by Acornsoft is potentially very useful, but I dislike the way it has been done. There is no doubt that the Acornsoft packs are very clever, but they appear to have been written by a programmer who knows little about business, rather than by a businessman who knows something about programming. In trying to be all things to all people, they have become too complex and would be unworkable in my business.

The Gemini system, on the other hand, doesn't try to be too clever. It just does the job – simply and competently. It works in a manner that any book-keeper would be able to master in no time at all and, if you are prepared to accept the restrictions of a standard-layout invoice, it will be quite at home in a small business environment.

Figure 2. Labels output from Gemini's mailing list software

```
KEYREF :FIL/SEARCHKEYS******
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*********Town/City**********
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Figure 1. Sample invoice from Acornsoft's invoicing pack

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COMMANDS

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***FREE**	Display free memory and pseudo variables.
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STOCK ANSWERS

Roger Carus reports on Acornsoft's 'Purchasing' and 'Stock Control' packages





'Purchasing' and 'Stock Control', Acornsoft, BBC B, £24.95 each

THESE two programs, part of a suite of seven programs produced by Acornsoft, are an excellent idea well put together, and if there are minor irritations in using them that should not detract from the merits of the plan.

The business manager considering solving all his paperwork problems for the hardware cost along with seven programs for under £175 would do well to see a full demonstration before settling on this system. Not that it doesn't work, but the investment is likely to be greater and the learning experience more painful. If our manager is already knowledgeable about the BBC micro then there is no great problem, but if not, read on...

The guides are identical except for the section that deals with the specialist function of the program concerned (see Barry Pickles' review of *Invoicing* and *Mailing List*), and they are written well and clearly in simple terms, presented in a folder which is very attractive, and convincing in its professional approach. I could have wished that the folder and the disc had made clear that a 40-track system was in use.

With the *Purchasing* and *Stock Control* programs working it was at last possible to see what they could do, and it was quite impressive. They had a common basic content which is described by the menu and appears as follows:

SYSTEM SETUP MENU
1 Name and Address
2 System Details
3 Modules in Use
4 Update Parms (parameters) File
5 Create Data Files
6 Extend Data Files
7 Exit

These need little explanation, for the menu-driven arrangement is remarkably easy to follow and produces the expected results as the options offered speak for themselves. The instruction to exit is rather important, as otherwise valuable data files may be corrupted. This menu is common to all programs in the suite and a model for such links, although some simple use of graphics could have been made to encourage the workers.

Taking first the *Stock Control* set of programs, there is again a menu which makes a convenient starting point for the description, and which appears as follows:

STOCK CONTROL MENU
1 Product Update
2 Stock Movements
3 Stock Level Report
4 Stock Analysis
5 Exit

For the first four options the immediate response is to request the data disc, which can then be updated with additional information – which in turn becomes available for all the other programs. Again, these options speak for themselves but I am satisfied they cover all the likely combinations of circumstances that most businesses will face. The list of products is almost unlimited in theory, and there is scope for predicting forward patterns and fixing warning levels for stock needs. So the range of stock can be easily changed and movements monitored with ever-ready reports of stock level, reconciliation for stock-taking purposes, and the associated valuation, with easy instructions to print out the reports in convenient forms on almost any printer.

The ways in which the *Purchasing* program links with *Stock Control* are obvious and they work as expected, so again it seems best to start with the menu:

PURCHASING MENU
1 Supplier Update
2 Item Update
3 Purchase Order Update
4 Order Progress
5 Order Analysis
6 Invoice Validation
7 Exit

These options are obvious to anyone likely to have a use for the program and, as the manual says, the purpose of the *Purchasing* module is to enable you to maintain supplier and item records; enter and maintain purchase order details; and record deliveries and analysis commitments made. It does all these and could maintain immaculate records for the business: perhaps it could even save a little money at the same time.

All very straightforward, but I wonder to what extent these programs would help a small business, as the advertising suggests. If the manager is a BBC micro enthusiast who wants to mix business with pleasure and turn his hobby to profit, then I have no reservations: buy it, it works! If on the other hand he is already very busy with customers and will have to delegate the keeping of records to staff with limited ability or interest, then there will be serious problems and these will hardly be solved by employing expensive staff: for a small business this would be uneconomic, and for a large one the BBC micro would be the wrong hardware. I suspect that to be cost effective the programs would have to be used with a relatively small number of products and suppliers, which in turn suggests high-cost items and a small turnover in terms of transactions.

There is, however, a use for these programs that is not mentioned in the advertising or in the manuals and that is in the training of students on business courses. Those concerned with the courses of the Business and Technician Education Council would find these programs invaluable for training students following the General, National and even Higher Certificate in Business Studies and it would be relatively simple to set up complex business simulation exercises using one group of students to input the data and a second to manipulate it in various ways. Acorn should give more thought to the true nature of its market.



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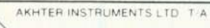
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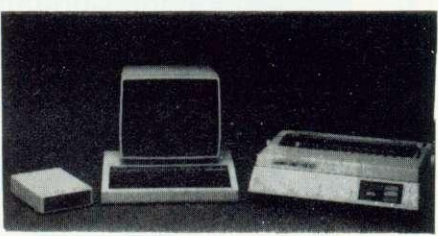
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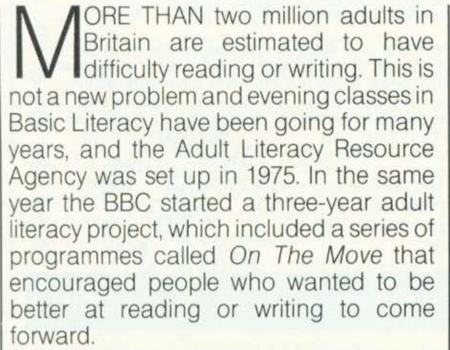
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READ/WRITE PROGRAM

Introducing the micro to adult literacy classes, by Jonathan Read

MORE THAN two million adults in Britain are estimated to have difficulty reading or writing. This is not a new problem and evening classes in Basic Literacy have been going for many years, and the Adult Literacy Resource Agency was set up in 1975. In the same year the BBC started a three-year adult literacy project, which included a series of programmes called *On The Move* that encouraged people who wanted to be better at reading or writing to come forward.



Several years later, people of all ages are still coming to evening classes in Adult Literacy or are being taught at home. The students know they have tried very hard in the past and not succeeded, and so the tutor needs to find work for the students that they can successfully carry out to prove to themselves they really can learn. They need plenty of reading and writing practice but the books available tend to be too difficult or too trivial, and students don't like to do writing because they think that makes them look stupid.

These factors prevent the students from becoming really involved in their work and they waste a lot of time trying to hide their ignorance from their tutor, and from themselves. Some students can put up a better front than others, but they all try to get the tutor to give them work that they already know so that they are bound to get it right. This is no help to the students.

The tutor has to find activities connected with reading and writing that the students have not done before but which they are prepared to try. Tutors use activities such as educational games or work-sheets for this purpose, and computers can be used as well. I am not saying a computer is bound to work better than other methods; its success will depend on how much the students like using it, and how well it fits in with their other work.

The computer should complement the tutor's qualities. It has more patience and more flexibility. The students do not seem to be afraid of using the computer, which may be partly due to its novelty, but if it does not enable real learning, students quickly lose interest.

To benefit fully from the patience of the computer, students need to work at their own pace without being made to carry on if they are not ready. It helps neither students nor tutor if the students are left in front of the computer, for the tutor loses the chance to learn from the students' mistakes and if the students get stuck the computer is too inflexible to do anything about it.

I have summarised the type of program that suits this approach best in a check-list (see panel), each point of which I will discuss in turn.

Surprisingly, point 1 is not always met – for example, programs often tell the student how long he has taken, or they ask a fixed number of questions. The student cannot therefore stop in the middle of the program without feeling he has failed to achieve what is required.

Point 2 is easy to violate accidentally. For example, a program that asks a question and says 'Well done!' when given the expected answer, or 'Are you sure?' when the student answers incorrectly and lets him have another go would not be satisfactory, because the students would soon learn to change their answer next time round and appear to know more than they actually do.

Programs written by teachers should not suffer from this fault.

Point 3 would not be satisfied by a program that asks a series of questions, at the end of which it says how many the students got right without saying which questions were answered correctly.

Point 4 needs stating because of the inflexibility of the computer, and should avoid the students being put off using it simply because they hit a wrong key.

Point 5 is probably the most controversial. Since the students have come to the lesson of their own accord they must want to learn and so they do not need marks to motivate them. The tutor should be present and so he gets a much better idea of how the student is doing than he could get from a mark given by the computer. Also, because the program is supposed to be teaching as opposed to testing the students it is not fair to count their mistakes.

The listing (page 113) is a program that I think satisfies the check-list.

The program flashes a word on the screen and the student has to read it. It was originally intended to help students who confuse words that look very similar, but it could also be used for revision before a spelling test, or if some of the words were spelt incorrectly the students could be asked to recognise which ones were right.

In use, the tutor presses the space bar down and the screen goes blank. It stays blank for as long as the tutor keeps the space bar down and so if the students need to pause to collect their thoughts the

page 117▶

CHECK-LIST FOR ADULT LITERACY PROGRAMS

1. **The computer works at the pace of the student, and it is always possible to stop when the student wants to.**
2. **The student cannot get everything right by using an incorrect idea of his own, so he needs to learn and understand what is being taught.**
3. **Feedback should be given as soon as possible, but not so quickly that it interrupts the students' train of thought.**
4. **The student should be allowed to change his answer before the computer checks it, unless the program is teaching speed or accuracy.**
5. **The computer does not maintain any record of the student's marks.**

```
  10 REM  (C)  J. M. Read
  20
  30
  40 REM  ______________  S E T   U P   C O N S T A N T S  ______________
  50
  60 MODE7:!&FE00=&10200A   :REM  Cursor Off
  70 DHEIGHT$=CHR$ 141
  80 Error=FALSE
  90 OutOfData=42
 100 Space= -99
 110
 120 Line=12:Col=15          :REM  Sets position of words on screen.
 130
 140
 150 REM  ___________________  C O U N T   W O R D S  ______________
 160
 170 ON ERROR GOTO 250
 180 NoOfWords=0
 190
 200 REPEAT
 210   READ W$
 220   NoOfWords=NoOfWords+1
 230 UNTIL Error
 240
 250 IF ERR=OutOfData GOTO 340
 260
 270 PRINTTAB(0,20);:REPORT:PRINT " at line ";ERL
 280 !&FE00=&10720A          :REM  Cursor On
 290 END
 300
 310
 320 REM  ____________________  M A I N   L O O P  ________________
 330
 340 LWordno=0:LWordno2=0
 350
 360 W$=FN_NextWord
 370 REPEAT UNTIL NOT INKEY(Space)   :REM  Wait for Space Bar to be Released.
 380 PRINTTAB(Col,Line) DHEIGHT$ W$
 390 PRINTTAB(Col,Line+1) DHEIGHT$ W$
 400 REPEAT UNTIL INKEY(Space)       :REM  Wait for Space Bar to be Pressed.
 410 CLS
 420 GOTO 360
 430
 440
 450 REM  ______________  C H O O S E   N E X T   W O R D  ____________
 460
 470 DEF FN_NextWord
 480   Wordno=RND(NoOfWords)
 490   IF Wordno=LWordno AND LWordno=LWordno2 THEN
                 REPEAT Wordno=RND(NoOfWords):UNTIL Wordno<>LWordno
 500   LWordno2=LWordno:LWordno=Wordno
 510   RESTORE:  FOR i=1 TO Wordno:READ W$:NEXT i
 520=W$
 530
 540
 550 REM  ____________________  W O R D S   U S E D  ________________
 560
1000 DATA There
1010 DATA Their
1020 DATA Then
1030 DATA Them
1040 DATA They
```

page 117▶

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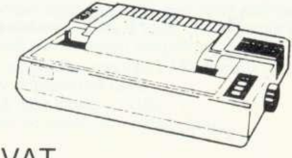
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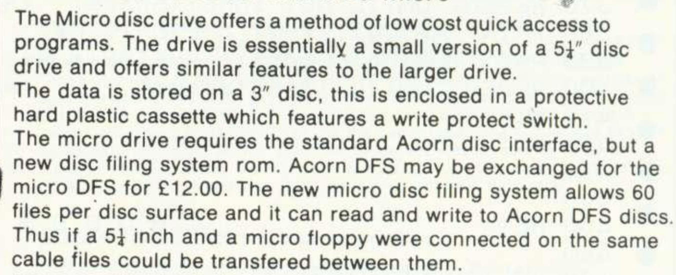
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MATHS FROM MANY ANGLES

Martin Wallis examines a mixed suite of programs for use in classroom question-and-answer sessions or discovery exercises

THE Association of Teachers in Mathematics has collected together a package of 11 programs for the BBC model B under the title *Some Lessons in Mathematics with a Microcomputer.* The programs are written by different teachers who have used them extensively in the classroom. As a result they are all well-tested and easy to use, either with the whole class or as an activity for a smaller group of pupils.

For each program, the colour-coded 100-page booklet supplied contains a brief description showing how to start using it, a reference guide and some suggestions about planning lessons using the program as an aid. But as the introduction says, 'There are very few firm rules about the way it (the microcomputer) should be used in a lesson', and the computer cannot be switched on at the beginning of a lesson, leaving the teacher, feet on desk, watching the class mesmerised by the screen. There are a variety of ways to use the programs to pose open-ended questions and to provide the opportunity for pupils to discover the answers for themselves.

To illustrate, *Build* allows the user to create three-dimensional structures in perspective using cubes on the screen, by keying in directions Up, Down, Left, Right, In and Out.

Build could be used to help pupils develop concise language to describe 3D structures. The class is divided into pairs with a small cardboard barrier between them. The pupils take turns to build a model with small plastic interlocking cubes and describe it to their opposite number across the barrier, who tries to reproduce it using only these verbal instructions. First attempts to describe the diagram of figure 1, such as 'a bridge four cubes wide and two tall, with an extra cube in front of the bottom of both legs', can be improved as they move on to use the computer to draw their structures and discover how the code I U R R R D O is easier to use and less open to misinterpretation.

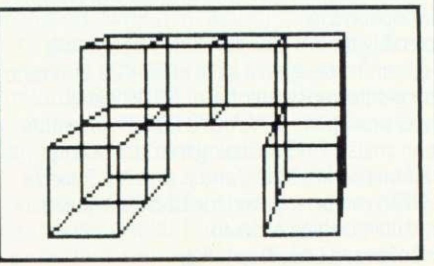


Figure 1. Three-dimensional structures are possible with 'Build'.

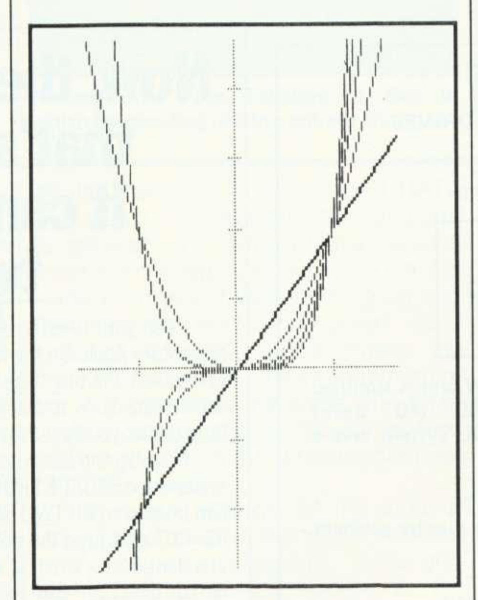


Figure 2. Dump from the function graph plotter program

Further developments could include drawing rotations and reflections, investigating different ways of producing the same shape and discovering the effects of inverse instructions.

What this program has in common with the others is that it is best used in a situation where pupils discuss their ideas with each other and with their teacher, who can provide help on what to investigate and encourage pupils to predict what will appear on the screen.

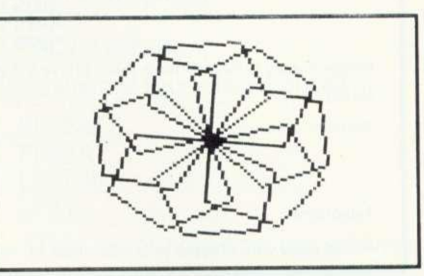


Figure 3. Recursive pattern produced in 'Track', a Logo-based picture-drawing language.

Two of the programs draw loci that would otherwise be difficult to produce. *Circles* gives the locus of a moving circle which passes through a fixed point and touches a fixed circle, and *Arms* displays two rotating arms and plots the path of a point on an imaginary piece of elastic stretched between their ends. In each case, groups of pupils can predict the effect of varying the position and size of the arms or the fixed point and circle and quickly discover how accurate they were.

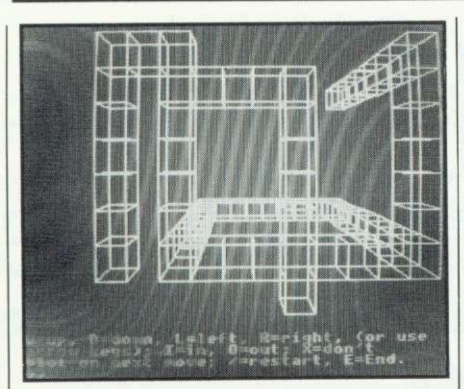
Two number games are included. In *Subgame,* five digits are displayed one after another and the user has to fit them into the pattern of a subtraction:

```
 a b c
 - d e
```

The computer does the same and you have to get an answer larger than the computer's. I would like to see an extension that allows larger numbers to be used, with the possibility of negative

THE PACKAGE

Disc and book cost £15 (including VAT and p&p) from ATM, Kings Chambers, Queen Street, Derby DE1 3DA. The book on its own costs £3, inclusive.


'Build' in action. The cursor control positions squares of a fixed size around the screen

answers, but the use of the program in reinforcing the skill of subtraction and the importance of place value are clear. *Ergo* displays a 5x5 grid with two numbers filled in, and you have to discover the rule which connects the 25 numbers.

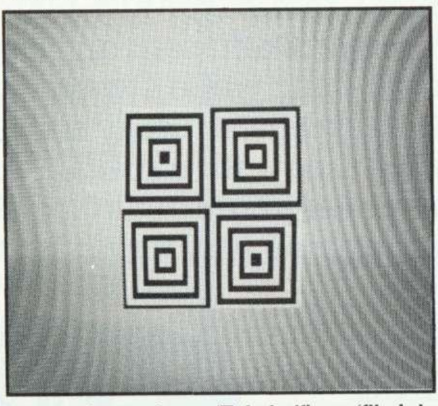
The function graph plotter (FGP is versatile and efficient. Illustrated here are the graphs of yx^n for varying values of n (figure 2).

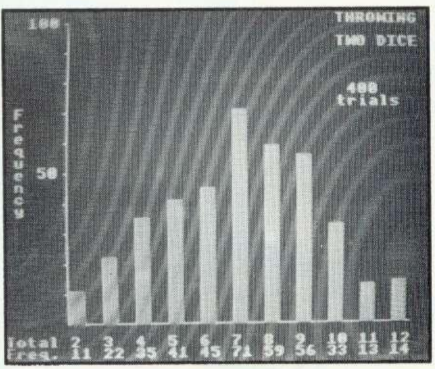
Dicecoin, as the name suggests, simulates repeated dice rolling or coin tossing and displays the data in a variety of ways. It is no substitute for pupils performing their own experiments and would be more useful if it catered for the tossing of more than two coins together as then it could reproduce experiments which are impractical in most classrooms.

Solve turns the computer into a calculator for linear equations of the form ax + b = cx + d, and shows clearly the effects of adding 7 to both sides of the equation, say, or dividing by 2.

Moves demonstrates the effects of linear transformations and includes the possibility of defining your own matrix. *Takehalf* is a fascinating program which runs like a film for about ten minutes showing a square which is shaded in constantly changing ways so that half the square is black and half is white.

Finally, *Track* is a picture-drawing language, based on Papert's Logo. A brief example will show the power of the program. The following six instructions define a pentagon, and whenever the instruction PENTA is typed, the shape is drawn on the screen:


Freeze-frame from 'Takehalf', a 'film' in which the shading within a square changes



'Dicecoin' simulates dice-throwing and coin-tossing, displaying the results graphically

```
DEFINE PENTA
REPEAT 5
FORWARD 30
LEFT 72 (degrees)
NEXT
END (of definition)
```

The pattern of figure 3 is produced by:

```
REPEAT 8
PENTA
LEFT 45
NEXT
```

ATM's set of programs are extremely robust, are easily used by pupils and teachers – even if they have not touched a micro before – and have applications not only in the secondary school but also in primary schools and at home, not to mention the staffroom.

READ/WRITE PROGRAM

◀page 111

tutor can let them do so. When the tutor releases the space bar the computer chooses a word at random from the ones in its DATA statement (lines 1000-1040) and shows it on the screen. The students have to read it and the tutor tells them if they were right. The students will soon get faster and then the tutor needs to say anything only when they have made a mistake. When the tutor has had enough of pressing the bar the students can have a go. This point 1 of the check-list is satisfied, which it would not be if the computer flashed up words at fixed intervals. Points 2 and 3 are satisfied by default, since the tutor does the marking, not the computer. Point 4 does not apply and point 5 is clearly satisfied.

There is one point about how the program works that is worth making. The computer selects the words by generating a random number and then displaying the corresponding word. (For example, if it came up with the number 2 it would display the word in the second DATA statement.) It is possible for the computer to generate the same number several times in a row, which would mean that the same word would keep coming up and the students would get bored. So I included line 490, which makes the computer generate a new random number if it generates the same one three times in a row, and so the same word never appears on the screen more than twice in succession.

This is an example of the kind of unexpected problem that can arise when writing computer programs. These problems are not always spotted by the programmer and so a program should not be assumed to be satisfactory until it has been successfully used a few times.

'More programs need to be written for adult literacy lessons. The important thing is to put yourself in the students' place and not to make them use a program you wouldn't use yourself'

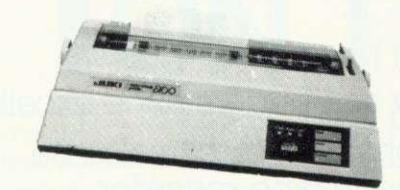
Other programs that could be tried include versions of Hangman and various word-finding games. A type of program that has potential is the word processor. It allows you to type in your text like a typewriter, except that it automatically starts a new line when the right hand margin is reached. If you need to correct your text you can insert any number of words anywhere in the text, and the rest of the word are automatically moved to make room.

The advantage to the students in doing their work this way is that it is always neat and tidy, and the tutor can correct it without the corrections showing. Note that the word processor also satisfies the points in the check-list, provided the tutor is present to satisfy the feedback requirement of point 3.

I have described how a computer can be used as an aid in adult literacy lessons *without it taking control.* More programs need to be written and my five-point check-list gives an idea of what is required. The most important thing is to put yourself in the students' place and not to make the students use a program you wouldn't use yourself.

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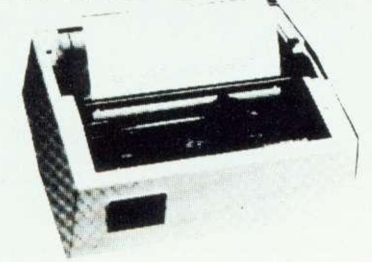
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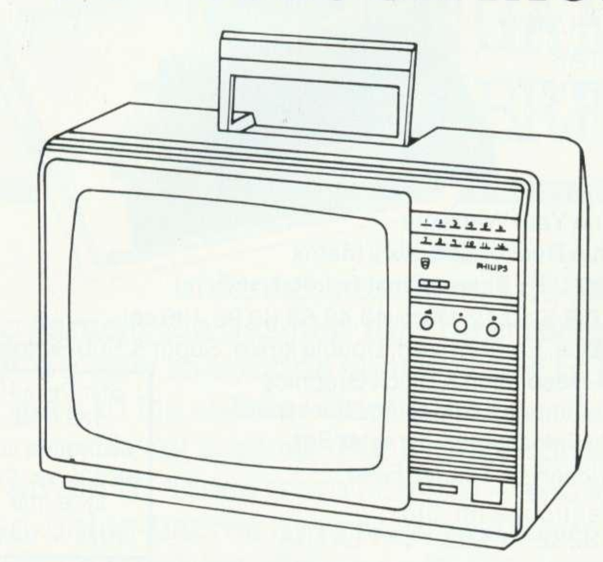
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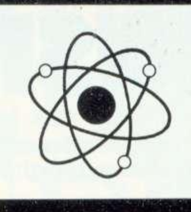
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ATOMIC LISTS ON THE BEEB



How the BBC takes on board Atom programs, by Vincent Fojut

MANY readers with access to both the Beeb and Atom will have been experimenting with the intercommunications programs in the December '83 *Acorn User*. Although there are many potential uses for the routines, their main purpose was to allow Atom files to be stored on disc via a BBC micro. This in itself presents no difficulties. A file is transferred to a given address on the Beeb, then stored to disc with the *SAVE command.

However, once an Atom file is loaded into the Beeb it is often useful to be able to list the program on the BBC's screen to verify that the transfer has executed successfully. Or perhaps you might want to print on a device permanently connected to the Beeb – for example, a serial printer, which cannot be used directly with the Atom. The problem is that it is not possible to use the BBC's LIST command to list an Atom file directly, since the two dialects are stored in different formats.

Tables 1 and 2 compare how a simple Basic program is stored on the BBC micro and Atom respectively. The dialects have one or two features in common. First, all lines start with a value of &D; following immediately, line numbers are stored as 16-bit binary values (high-byte first, contrary to 6502 convention); and the end of the program is marked in both cases with a byte of &D immediately followed by a negative-value byte (usually, but not necessarily, &FF). This also accounts for the maximum line number limit of 32767 – anything larger creates a negative high byte, which would be misinterpreted as the end of program text.

However, that is more or less where similarities end. Line numbers in BBC Basic precede a single byte giving the length of the current line, including &D, line number and length byte itself (which speeds up those processes that need to scan through a Basic program, such as RENUMBER). Also, Basic commands such as "PRINT" and "END" in the example, are stored as single-byte tokens. While this ensures BBC Basic is relatively compact (and fast), it complicates the requirements of the Beeb's LIST command, since it needs to convert the tokens into an intelligible, ASCII string form. Regardless of whether the command is entered on the Beeb in complete or abbreviated form, it will always be converted into a single-byte token and is always reconverted into its 'fuller' format when listed.

By contrast, commands are held on the Atom (along with the rest of the line) exactly as entered, i.e. "P" will take up two bytes, while "PRINT" takes up five. Although this generally consumes more memory than a similar BBC Basic construct, it greatly simplifies the operation of the Atom's List.

Now since a string in Basic refers to a series of ASCII characters terminated by a carriage return (&D), it follows that Atom Basic files may also be looked at as a sequence of strings, separated by 16-bit binary line numbers. Once an Atom file is perceived in this way, it becomes surprisingly easy to write a suitable program for listing them on the Beeb, as shown in program 1. The program assumes that an Atom Basic file has been transferred to a given location in the Beeb's memory using, for example, December's communications programs.

The main program loop is from lines 220 to 280. Each line number is converted and printed, then the following line of text is accessed and printed as if it were any other Basic string, using the string indirection operator, $. This process is repeated until the negative byte, marking the end of program text, is detected (line 280). Line 250 prints a space after each line number, if this option has been selected at the start of the program. (For more extensive Atom program formatting, see March's *Acorn User*.) The output may also be directed to an appropriate printer channel.

Apart from its obvious uses in listing Atom files on BBC-dedicated printers, the routine can also serve as a useful first step in the conversion of Atom programs to

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Program 1. Lists Atom Basic files on the Beeb

```
 10 REM Atom Basic lister for BBC micro
 20 REM (C) V. FOJUT, 1984.
 30
 40 T%=@%: REM save Print format
 50 @%=5 : REM new Print format
 60
 70 REPEAT
 80   INPUT"ADDRESS OF ATOM PROGRAM",start$
 90   Pointer=EVAL(start$)
100   IF ?Pointer<>&D PRINT"BAD ADDRESS"
110   UNTIL ?Pointer=&D
120
130 PRINT"SPACE AFTER LINE NO.(Y/N)?"
140 PROCyesno
150 IF yes space=TRUE ELSE space=FALSE
160
170 PRINT"OUTPUT TO PRINTER (Y/N)?"
180 PROCyesno
190 IF yes THEN VDU2
200
210 Pointer=Pointer+1
220 REPEAT
230   lineno=(?Pointer)*256+Pointer?1
240   PRINT lineno;
250   IF space PRINT" ";
260   PRINT $(Pointer+2)
270   Pointer=Pointer+3+LEN($(Pointer+2))
280   UNTIL ?Pointer>&7F
290 VDU3:  REM disable Printer
300 @%=T%: REM restore Print format
310 END
320
330 DEFPROCyesno
340 yes=FALSE
350 REPEAT
360   reply$=GET$
370   UNTIL INSTR("YNyn",reply$)
380 IF reply$="Y" OR reply$="y" yes=TRUE
390 ENDPROC
```

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Barry Pickles lists the new 6502 instructions – plus the quest for the random number, sideways scrolling techniques, Basic bugs

The new 6502 op-codes

AS PROMISED last month, here are details (opposite) of the newly discovered instructions for the 6502 processor. They are laid out in the usual format, but you should note that these codes are undocumented by Mostek and, if you want to use them, you will have to 'hand-assemble' them, since no mnemonic assembler/disassembler will recognise them.

However, they do work and, as well as providing some new operations and addressing modes, save both memory and time.

The saving, in each of the dual-operators, relates to the second operator. That is to say, the number of bytes saved is exactly the number that would have been required by the second operand, and the processing time used is that of the first operand *plus* one cycle. Table 1 gives the memory and timing figures for all the dual-operator instructions.

You will need to take care if your program tests the state of the flags, since, although the flags affected are shown, the same flag may be affected by each 'half' of the operator, depending upon what you are doing. The rule is that the flags will be affected in the same manner as if you had used separate operators. The HALT instructions are included only for completeness – I can see no practical use for them, as only a hard reset (ie, pressing BREAK) has any effect after this instruction.

Out of a possible 255 instructions, we now have only eight unused. These are 64/83/93/9B/9E/AB/BD/D4. Some of them appear to do something, but the effects seem unpredictable. Finally, note that all numbers are in hex.

Addressing mode	Bytes used	Cycle time
Zero page	2	6
Zero page, X	2	7
(Indirect, X)	2	10
(Indirect, Y)	2	10
Absolute	3	7
Absolute, X	3	8
Absolute, Y	3	8
Immediate	2	2

Table 1

Invented a routine or discovered a hardware modification for the Atom? Here's a chance to show your originality and win some cash. Send your idea to: Atom Forum, Acorn User, Redwood Publishing, 68 Long Acre, London WC2E 9JH.

NOW WE ARE ONE!

WITH this issue 'Atom Forum' is one year old, so I would like to thank all those who have contributed to this column during that time. However, I've noticed a decrease in the number of submissions recently. Surely we haven't said everything there is to say about the Atom? Remember, this is *your* column, so keep 'em coming!

Basic bugs

M CONSTANTINE of East Grinstead writes with a note of two bugs in AtomBasic.

If you wish to transfer data between programs then the array in which it is stored can be positioned in memory so that when the second program is loaded it doesn't overwrite the data. This is done by POKEing the free space pointer #23 and #24 with the starting address of the array. If the identical address is used in both programs and an identical array dimensioned in each the data will remain intact.

The problem arises when two or more arrays are needed. In these cases element 0 of the second and subsequent arrays will be corrupted. This is because the interpreter checks that it has not run out of space by writing and reading to the first memory byte past the end of the array being dimensioned.

There are two solutions. The first is not to use element 0 and the second involves repositioning the free space pointer after dimensioning each array, either by leaving a lot of space between the two arrays or by adding 1 to the pointer after dimensioning each array to skip over the corrupted byte, thus:

```
10  ? #23 = 0;  ? #24 = #82
20  DIM AA(N)
30  ? #23 = ? # 23 + 1 ;
    IF ?# 23 = 0; ? #24=
    ?#24+1
40  DIM BB (N)
50  REM REST OF YOUR PROGRAM
```

The second bug concerns the use of spaces in basic programs. Try this one:

```
10  %A = 6.55
20  %B = -%A; REM NO SPACES
30  %C = - %A; REM NOTE THE
    SPACE
40  %D = 10-%A;REM NOTE NO
    SPACES
50  %E = 10 - %A; REM NOTE
    THE SPACE
60  FP.%A'%B'%C'%D'%E
70  END
```

When run, %C will have the wrong value, but the rest are correct.

This tip earns Mr Constantine £5.

Practically random

A SOLUTION to the problem of 'genuine' random numbers on the Atom is offered by Dirk Wriedt of Kappeln, West Germany, who wins £5.

The random numbers produced by the Atom's random number generator are not really random. If you are dissatisfied with that and have a VIA fitted, this is the solution: use timer/counter 2 (#B808). The timer continuously decrements at 1Mhz, as long as bit 5 of the auxiliary control register (#B80B) is set to 0.

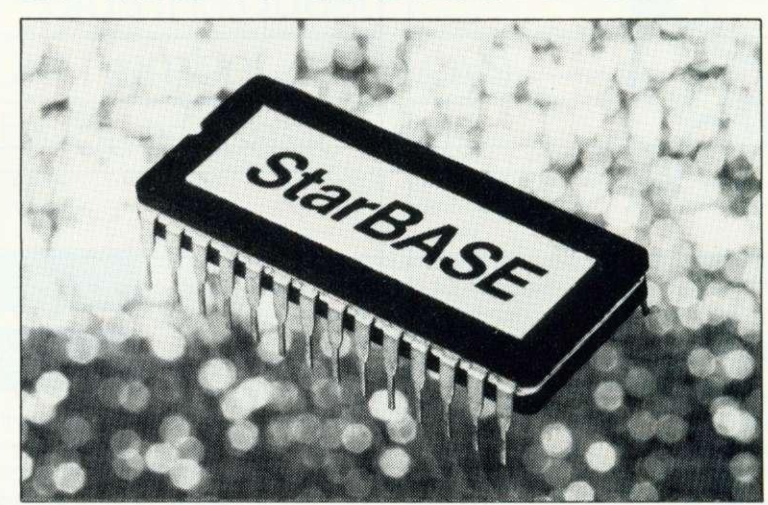
When the counter reaches zero, it recommences at its maximum count, 65535. You might stop it by setting bit 5 of the ACR to 1 (then the counter decrements on each low-going pulse on PB6, and if there are no pulses, the counter does not count).

If you now need 'real' random numbers, you can feed the generator with the

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NEW OP-CODES	Addressing
ASL-ORA shift left memory one bit then OR Acc with result Operation: C <-- 7 6 5 4 3 2 1 0 <-- 0; A=A v M NZCIDV %%%---	Zero (07) Zero,X (17) Ind,X (03) Ind,Y (13) Abs (0F) Abs,X (1F) Abs,Y (1B)
ROL-AND rotate left memory one bit then AND Acc with result Operation: C <-- 7 6 5 4 3 2 1 0 <-- C; A=A & M NZCIDV %%%---	Zero (27) Zero,X (37) Ind,X (23) Ind,Y (33) Abs (2F) Abs,X (3F)
LSR-EOR shift right memory one bit then EX-OR Acc with result Operation: 0 --> 7 6 5 4 3 2 1 0 --> C; A=A : M NZCIDV %%%---	Zero (47) Zero,X (57) Ind,X (43) Ind,Y (53) Abs (4F) Abs,X (5F) Abs,Y (5B)
ROR-ADC Rotate right memory one bit then add result to Acc Operation: C --> 7 6 5 4 3 2 1 0 --> C; A=A + M NZCIDV %%%--%	Zero (67) Zero,X (77) Ind,X (63) Ind,Y (73) Abs (6F) Abs,X (7F) Abs,Y (7B)
LDX-LDA Load both X register and Acc with memory Operation: X = A = M NZCIDV %%----	Zero (A7) Zero,X (B7) Ind,X (A3) Ind,Y (B3) Abs (AF) Abs,Y (BF)
DEC-CMP decrement memory by one then compare result with Acc Operation: M= M-1; A --> M NZCIDV %%%---	Zero (C7) Zero,X (D7) Ind,X (C3) Ind,Y (D3) Abs (CF) Abs,X (DF) Abs,Y (DB)
INC-SBC Increment memory then subtract result from Acc Operation: M= M+1; A= A - M NZCIDV %%%--%	Zero (E7) Zero,X (F7) Ind,X (E3) Ind,Y (F3) Abs (EF) Abs,X (FF) Abs,Y (FB)
ROL-ORA rotate left memory one bit the OR Acc with result Operation: C <-- 7 6 5 4 3 2 1 0 <-- C; A= A v M NZCIDV %%%---	Abs,Y only (3B)
AND-LSRA AND Acc with data then shift right one bit Operation: A= A & M; A= 0 --> 7 6 5 4 3 2 1 0 --> C NZCIDV 0%%---	Imm. only (4B)
TXA-AND transfer X reg. to Acc then AND Acc with data Operation: X --> A; A= A & M NZCIDV %%----	Imm. only (8B)
STZ store zero in memory; A,X and Y unaffected Operation: M= 0 NZCIDV -%----	Abs. only (9C)
SAX AND Acc with X reg. then store result in memory Operation: A= A & X; A --> M NZCIDV %%----	Zero (87) Abs (8F) Abs,X (9F) Zero,Y (97) N.B: This instruction takes 3 extra cycles
SBX AND Acc with X reg. then subtract (WITHOUT CARRY) data Operation: A= A & X; A= A - M NZCIDV %%---%	Imm. only (CB) takes 5 cycles
NOP xx wait 2 cycles; ignore byte following	Any of the following codes: 04/14/34/44/54/74/80/89/F4 Bytes: 2 Cycles: 2
NOP xxxx wait 3 cycles; ignore both bytes following	Any of the following codes: 0C/1C/3C/5C/7C/DC/FC Bytes:3 Cycles: 3
HALT disable processor until reset (see text)	Any code (except A2) whose LSB is 2
The following codes are duplicates of existing op-codes and are included here only for completeness:	AND (imm): 0B or 2B SBC (imm): EB NOP : 1A/3A/5A/7A/DA/FA

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contents of !#B808 at the beginning of your program, which are practically random, because it is nearly impossible for you to run your program twice at a specified count of !#B808. Setting is made by !8=!#B808.

Another solution is to use #B808 itself as the random number generator. Instead of using ABSRND%8, for example, take !#B808%8.

Before accessing the counter, make sure bit 5 of #B80B is set to 0, eg, by ?#B80B=0.

Chip famine

YOU will, no doubt, have seen the reports of a world-wide chip 'famine'. This is now beginning to affect the Atom, with supplies of the 8271 disc controller and, more seriously, 2114L RAM chips becoming hard to get. Any individual or supplier who knows of a reliable source, please get in touch with me care of the magazine so we can pass on the information.

Sideways scroll

I S JONES of Llanystumdwy, Criccieth, sent in a *Sideways Scroll* program (listing 1) that wins him £10.

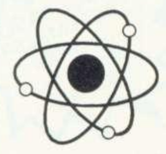
This routine allows the high-resolution mode 4 screen (black and white) to be revolved sideways. The graphic screen is shifted right one pixel each time, while the pixels that disappear on the right of the screen re-appear on the left. Each call to the routine shifts the screen once.

The routine works by RORing (ROtate Right) each memory location in turn and could be easily adapted to revolve only part of the screen (change lines 30 and 250). A demo is enclosed at the end of the program which revolves 0 sine curve continuously.

The routine is called using LINK BB0.

```
  5REM:  Side-Scroll
  6REM:  I.S. Jones
  7REM:ACORN USER-6:84
  8REM:
 10DIM BB6;F.I=1TO2
 20DIMP-1;P.$21;[
 30:BB0 LDA @#80
 40 STA BB2+2
 50 STA BB3+2
 60 LDA @00;STA BB2+1
 70 STA BB3+1
 80:BB1 LDX @31
 90:BB2 LDA #8000,X
100 ROR A;LDX@0
110:BB3 ROR #8000,X
120 INX;PHP;CPX@32
130 BEQ BB4
140 PLP;JMP BB3
150:BB4 LDA BB2+1
160 PLP;CLC;ADC@32
170 CMP @00;BEQ BB5
180 STA BB2+1
190 STA BB3+1
200 JMP BB1
210:BB5 LDA @00
220 STA BB2+1
230 STA BB3+1
240 LDA BB2+2
250 CMP @#98;BEQ BB6
260 INC BB2+2
270 INC BB3+2
280 JMP BB1
290:BB6 RTS
300];P.$6;N.
310REM**  DEMO  **
320CLEAR4;F.X=0TO256
330%Y=X*PI/32
340%Z=(SIN(%Y)*50)+100
350Y=%Z;MOVE X,Y
360DRAW X,Y;N.
370DO LI.BB0;U.0
```

Listing 1. High-resolution mode 4 screen scrolled sideways



ATOM LISTS ON THE BEEB

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BBC Basic. The reason is simple. Now that you can list Atom programs on the Beeb, you can also generate pure ASCII files (using the *SPOOL command). These can then be fed into a Beeb-based word processor and many conversions performed automatically. Virtually all word processors have a facility to find, and optionally change, all occurrences of one string to another. This is just what you need to alter all DOs to REPEATs, all semicolon separators to colons, and so on. The resultant file can then be *EXECed into the Beeb and will automatically be converted into tokenised format, suitable for running directly.

If your BBC micro is not fitted with a word processor, don't despair. Use *SPOOL to generate an ASCII file from the Atom source, then *EXEC it straight back into the Beeb. This at least tokenises all commands that the BBC micro recognises. Any remaining modifications can then be done using normal editing procedures. Although the latter option may sound tedious, it should be a good deal less time-consuming than writing the program from scratch!

Highlighting the similarities and differences between Atom and BBC Basic can only benefit both parties of users, since each can learn from the functioning of the other machine, as well as their own. If you're lucky enough to use both machines, such information is particularly relevant. Perhaps the program and techniques outlined above will help more users to get the most out of the powerful combination.

Table 1. How a BBC Basic program is stored

ADDR.	VALUE	MEANING
1900	0D	START OF LINE
1901	00 0A	LINE NO. (10)
1903	0C	LENGTH OF LINE
1904	F1	TOKEN FOR "P." (=PRINT)
1905	20 41 3A 20	ASCII: " A: "
1909	F1	TOKEN FOR "PRINT"
190A	20 42	ASCII: " B"
190C	0D	START OF LINE
190D	00 14	LINE NO. (20)
190F	05	LENGTH OF LINE
1910	E0	TOKEN FOR "END"
1911	0D FF	END OF PROGRAM.

Table 2. How an AtomBasic program is stored

ADDR.	VALUE	MEANING
2900	0D	START OF LINE
2901	00 0A	LINE NO. (10)
		REST OF LINE IN ASCII:
2903	50 2E 20 41 3B 20	"P. A;"
2909	50 52 49 4E 54 20 42	"PRINT B"
2910	0D	START OF LINE
2911	00 14	LINE NO. (20)
		REST OF LINE IN ASCII:
2913	45 4E 44	"END"
2916	0D FF	END OF PROGRAM.

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* Search for byte string - define in Hex or ASCII.
* Overwrite any section - Hex or ASCII mode.
Search/Replace string * search current BASIC program (anywhere in RAM);
* search string can include BASIC keyword tokens & 'wild cards';
* each occurrence highlighted within whole program line;
* direct connection to List Peruser;
* **Replace** option allows longer or shorter strings;
Program repair * makes any 'Bad Program' available for editing.
Variable Dump * lists the names & contents of all non-array program variables;
List Formatter * lists program in easy-to-read format: automatic indents, breaks up multi-statement lines, highlights keywords etc.
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All main programs allow output to Printer using simple 'toggle'.
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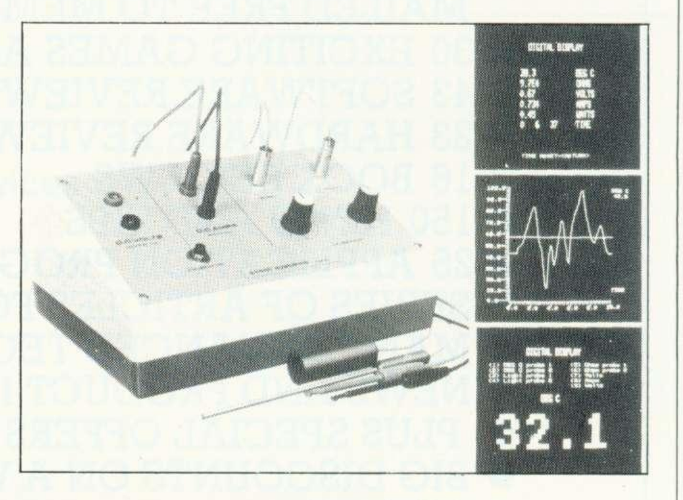
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Putting on the Ritz, Simon Dally eavesdrops on some business talk. Can you sort out the sales claims of two boastful, boozy tycoons?

DIVIDING THE SPOILS

TWO millionaires in the home computer business were chatting recently over a drink at the Ritz.

'You know,' said SCS to CC (like all true tycoons these grand people were known only by their initials), 'I can't possibly disclose my sales figures to you. But I don't mind telling you, old boy, that in the last six months the number of machines sold by my toiling serfs was exactly divisible by 13. Moreover, if you divide the number by 2 you get a remainder of 1, divide it by 3 you get a remainder of 2, divide it by 4 and the remainder is 3 – and so on until you divide by 12 and the remainder is 11.

'By the way,' he added, 'let me know if you need a back-door entrance to Mensa. Just because you're a bit short in the old IQ doesn't mean you can't join.'

CC sipped ruminatively on another Harvey Wallbanger. 'Was the number of units you sold the lowest possible number with those particular characteristics?' he ventured.

'It was indeed,' beamed SCS.

CC took another sip. 'In that case, SCS, I'm sorry to inform you that my sales figures also obey the characteristics described by you. I'm sure you don't want to hear this, but I can assure you that my serfs sold a lot more computers than yours – nearly three times as many, in fact. As for Mensa, I wouldn't join any club that would accept me for a member. Pip pip!'

How many computers did the tycoons sell respectively? Answers on a postcard, please, to arrive not later than 6 July 1984. Address your entries to June Competition, Acorn User, 68 Long Acre, London WC2E 9JH.

See panel for the super ROM prizes worth more than £600!

▼ ***FIRST PRIZE!*** SIDEWISE ROM BOARD, plus 4 ROMs: Wordwise, Disc Doctor, Graphics and Caretaker (Basic utility). — Worth £190

● ***TWO SECOND PRIZES!*** Three ROMs: Graphics, Disc Doctor and Caretaker. — Worth £100

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PRIZES SUPPLIED BY:



FEBRUARY COMPETITION

The February 'Magic Squares' competition produced roughly 50 entries, all but three of them correct. The correct answer was:

17	171	126	54	230	100	93	264	145
124	66	290	85	57	168	162	23	225
216	115	75	279	198	29	170	76	42
261	186	33	210	68	38	200	135	69
50	270	92	87	248	165	21	153	114
105	51	152	150	27	207	116	62	330
138	25	243	132	58	310	95	63	136
190	84	34	184	125	81	297	174	31
99	232	155	19	189	102	46	250	108

The winners were A P Selby of London and R Nagorwat of Stafford. Deepest sympathies go to Stephen Cree of Merseyside, who spent 112 hours programming his computer before coming up with the answer – he pointed out that in that time Paul McCartney had earned £282,240, whereas all he was aiming at was £20 worth of software – and to the Reverend Seed of Fort Augustus who toiled for 'many hours and days' in vain. Sometimes even the deity fails to assist RAM-wise.





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SCREEN TEST

Chris Drage sees how two colour and two monochrome monitors cope with his nine-part test program

Choosing the right visual display unit (VDU) for your micro can be just as big a headache as choosing the right micro itself. The unsteady, fuzzy display on the family television soon begins to pall – as do the demands to turn back to *Top of the Pops!*

Anyone aware of the potential of his computer's graphics facility quickly realises that a monitor is essential if those lovely multi-coloured images are to be appreciated, and to read the Beeb's 80-column text on anything other than a medium to high resolution monitor for any length of time could damage your eyes.

But which monitor? The range of choice has grown extensively in recent months. It's a choice not only of brand but of the facilities on offer. I've selected four monitors for comparison that I feel represent the spectrum of choice.

To establish an objective means of comparing them I've borrowed a variety of VDU tests from a number of sources, one or two of which readers may be familiar with. The program on yellow page viii will be of use in evaluating your own VDU or any you may consider buying. It is menu-driven, allowing you to perform each of the tests at the touch of a key (press the spacebar to return to the menu).

Before we look at the monitors let's see what we are testing them for.

Test A This fills the screen with random lower case characters in mode 0. Each character should be distinct and easily read.

Test B Alternating inverse Ms and Ws. Monitors find these letters difficult to resolve. Check particularly at the screen edges.

Test C This causes the screen to flash alternately between black and white, testing whether the monitor's power supply can cope with rapid changes. The effect of the screen collapsing inwards is normal. The build-up of the white screen should happen instantly, however.

Test D There are 15 horizontal white bars printed across half a mode 0 screen. The spaces between each should be uniformly black, as should the right hand side of the screen. Uneven shades of black indicate the low frequency of the monitor.

Test E The border drawn round the screen should be straight and fit on the screen evenly on all sides.

Test F The solid circle drawn in mode 0 should be central and show no tendency to be oval.

Test G This is a severe test of a monitor's ability to resolve colours and keep a steady screen. Each band should be distinguishable.

Test H A monitor should be able to display text/graphics instantly and remove them instantly. No image should remain on the screen after the text is removed.

Test I The colour test is included to enable a comparison of the clarity, richness and depth of the colours (or shades).

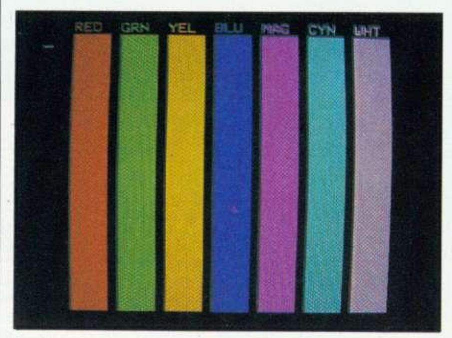
How each review monitor coped with these tests can be seen in the test summary chart on page 136.

My first impression of the Novex colour monitor was of a tall and 'boxy' appearance, but the metal casing is strong and well styled. As with all the monitors reviewed here its colour matches the BBC system very well. I particularly liked the strong carrier handles on each side – ideal for school use where monitors may have to be carried up and down stairs. Its height means that in use it can be positioned comfortably behind the BBC micro, as the bottom edge of the display is at least 100mm (4in) above the working surface. The depth of working surface needed to accommodate both is a hefty 750mm (30in), however. As it's a standard resolution monitor the manufacturers have been able to include useful additional facilities.

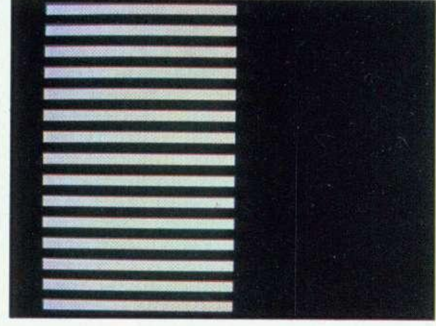
The Novex 14-inch is designed to work with micros with either separate RGB and synchronising signals at TTL level or a composite video signal. Both inputs are on the rear of the cabinet, the former an eight-pin DIN socket and the latter a phono connector.

The video input allows you to share the Novex with the home video recorder – a real bonus. The full tone colour pictures from a video recorder were very satisfactory. An audio input is supplied, designed specifically for amplifying the sound channels of micros. Its sound

The solid circle in mode 0 should be central and properly round



In this test of colour resoution each colour band should be distinguishable



The spaces separating the horizontal white bands should be evenly black

quality is quite adequate for this purpose.

The controls are all sensibly at the front of the monitor. The on/off button (volume control) is surface-mounted, but all other controls are in a covered panel below the screen, easily accessible yet well protected.

Perhaps the most novel feature of the Novex monitor is its facility to switch off the red and blue guns, thus allowing the screen to display green text only. Whether this is useful is debatable. It works perfectly well with 40-column text but is not suitable for 80-column work because the slot-mask becomes more apparent when only one gun is functioning. It is not clear whether the overall colour balance would be affected after prolonged use of the green display.

The picture geometry is good without any noticeable distortion. Picture brightness and contrast are good and colours reproduced satisfactorily. The overall resolution is acceptable but would not be suitable for long-term viewing of 80-column text.

With its bonus feature of video and sound input and a satisfactory overall performance the Novex 1414 is good value for money and can be recommended.

The difference in size between the Kaga Vision 3 and the Novex couldn't be more striking. The Kaga is a compact little monitor and this is due entirely to the fact that this is a 12-inch monitor. Although it is available in three models (medium, high and super-high resolution), I chose the last to review as this is described as 'a perfect match for the BBC micro's graphic capabilities'.

It's a good-looking monitor with matching plastic cabinet and sloping screen. The angled screen is an advantage when using the monitor on a plinth. The cabinet seems a bit thin and I wonder how the monitor would stand up to the rigours of an educational environment. The most serious oversight is the lack of a carrying handle. The screen is mounted in a light-brown, non-reflective surround which has four clips to accommodate a detachable, anti-glare hood. I should hardly think a Kaga owner would need one, however, because the monitor has a non-glare screen.

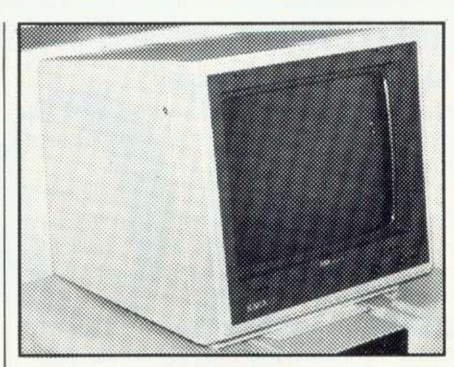
One of the features that sets it apart from others is its 'matt black' tube. Its colour reproduction must be seen to be believed. It performs equally well in bright lighting as it does in a shady corner. The non-reflecting screen is a boon to writers using it for word processing; unwanted reflections are kept at bay with no apparent loss of character definition.

Only two controls are visible – on/off switch and brightness control. A whole range of picture adjustments are available at the rear. Kaga includes an adjusting tool and a comprehensive manual to enable the user to get the best out of the display. I was pleased from the teacher's point of view to see that these controls are snuggly recessed out of the reach of little fingers. The same is also true of the ventilation grill at the top rear of the cabinet.

'If you can afford it and you want to get the best out of your Beeb the Kaga Vision 3 is in a class of its own'

As it is not possible to include a PAL/video facility on high-resolution monitors like the Vision 3, Kaga has opted to include this and an audio output facility in its Vision 1 standard-resolution model. Vision 3 has an interface which allows both linear and TTL inputs. Two sockets are provided: an eight-pin linear RGB connector and an eight-pin DIN for the two possible TTL inputs. A three-way selector switch on the rear panel thus ensures that the Kaga can be used by any computer with a true RGB output – most useful if you want to use the monitor with a variety of computers.

As a colour monitor Vision 3 excels. The reproduction of mode 0 graphics is excellent. The results from the test program speak for themselves. What impressed me was the fact that I was able to use the monitor to write this review in 80 columns with the View word processor. All characters are clearly reproduced and using it for hours on end caused no discomfort. The clarity almost matches that of a monochrome monitor. My only criticism concerns the geometry of the display. The top portion tends to splay out slightly, distorting any rectangles or squares that happen to be in that region. Despite this small niggle I find now that I compare all the monitors I see with the Kaga Vision 3.



The Kaga Vision 3 monitor's colour reproduction 'must be seen to be believed'

Not everyone can afford the outlay for even a standard-resolution colour monitor. For those who would be content with a simple, affordable alternative to the family TV the answer may be a monochrome monitor. Prices for these sets usually hover between £70 and £120 and there's plenty of choice. The two reviewed below are just a sample of what is available.

The Sanyo DM8112CX data display monitor is not to be confused with a similar product marketed by Sanyo of Taiwan. The Sanyo under review is made in Japan and is distinctly recognisable by its non-glare panel.

This monitor is cased in a plastic cabinet and like the Kaga has no carrying handle, but this is not such an inconvenience as monochrome monitors are generally much lighter than their colour counterparts. The colour matches the BBC micro's case accurately and the overall effect is pleasing. The design of the cabinet makes it particularly suited to being stood on a plinth above the micro. Video input is via a phono socket mounted on the back panel. On the front are just two controls: the on/off switch and brightness control. There's contrast control at the rear. I found this to be inconvenient – I would have preferred them both to be at the front.

The Sanyo has a green phosphor tube and all colours are reproduced in shades of green. The display is rather small and cannot be adjusted. However, the picture geometry is very good. High-resolution graphics are accurately reproduced and mode 0 proved no problem at all. For a green screen monitor the degree of persistence (afterglow) is very good indeed. My only criticism concerns the anti-



The robust Novex colour monitor (right) is ideal for school use. The Novex green screen monitor (left) has many of its larger relative's good features

glare panel on the front. It may stop glare from the tube but it picks up numerous reflections from a bright room. The reproduction of 80-column text is excellent, making this monitor a good choice for business users.

The Novex 12/500MG green screen monitor may be familiar to some readers in its other guise: the BBC (official) monitor. Looking very much like a smaller version of the Novex 1414, it has many of the good features of its larger relative. The design enables the monitor to be positioned either on a plinth or on the working surface behind the computer.

It is cased in a strong metal cabinet with a single carrying handle on the top, set flush. As in the 1414 model, the colours match the BBC system perfectly. The screen has a good non-glare matt finish and is easy to use even when light is shining on it directly from a window.

Two phono sockets are provided on the back for video in/out. The video out facility enables bridging of monitors, which must be useful in some applications. A 40/80 column switch is also to be found at the rear, enabling the user to select a semi-permanent setting of screen mode width. I liked the illuminated on/off rocker switch on the front – a good touch, this. Other user controls are accessed via a small recessed panel, and a superb range of adjustments are available, a design I found most convenient.

The Novex displays text clearly in 80 columns, ideal for use with any monochrome word processor package (View, BeebPen etc). The geometry is excellent and screen borders perfectly straight. High resolution mode 0 graphics are accurately reproduced. My main criticism of the Novex 12/500MG is the degree to which it suffers from persistence. Even so, it's not as bad as some green screen monitors on the market and many users will find it quite acceptable. If this is a vital factor then choose the amber screen version (12/500A), which displays no afterglow at all.

Overall the Novex 12/500MG is a delightful little monitor to use. Its all-round performance is ideal for most applications. This, coupled with its reasonable retail price, prompts me to recommend it highly.

Which one should you buy? There are too many factors involved to give specific answers. If a budget-priced general-purpose colour monitor is required then the Novex 1414 should be high on your list. If you are a business user or writer either of the two monochrome monitors mentioned will do the job. If you can afford it and really want to get the best out of your Beeb the Kaga Vision 3 is in a class of its own.

My thanks to Retail Control Systems and Technomatic for technical assistance in helping to prepare this review. **CD**

DATASHEET

Product: Novex 14in colour monitor (NC-1414-CL-UK)
Manufacturer: Novex Electronics, Hong Kong
Purpose: Standard RGB/PAL video monitor
Dimensions: 385 × 370 × 355mm (W × D × H)
Weight: 14.7kg
Resolution: 452 × 585 lines
Band width: 7MHz
User Controls: PAL: colour, contrast and brightness. RGB: V-hold, brightness. Picture selection switch, power on/off
Price: £199.95 + VAT + carriage
Review copy from: Retail Control Systems, Enterprise House, Central Way, North Feltham Trading Estate, Feltham, Middlesex.

Product: Novex 12/500MG green phosphor 12in monitor
Manufacturer: Novex Electronics, Taiwan
Purpose: High-resolution monochrome monitor
Dimensions: 300 × 300 × 275mm
Weight: 8.4kg
Resolution: 1000 × 800 lines
Band width: 20MHz
User Controls: Contrast, brightness, V-hold, H-hold, H-width, V-size, hi-low input level, graphic/text switch, power on/off
Price: £75.62 + VAT or £86.12 + VAT (non-glare screen)
Review copy from: Retail Control Systems, Enterprise House, Central Way, North Feltham Trading Estate, Feltham, Middlesex

Product: Kaga Vision 3 12in colour monitor
Manufacturer: Kaga Electronics, Japan
Purpose: High-resolution RGB anti-glare monitor
Dimensions: 320 × 393 × 303mm
Weight: 12.5kg
Resolution: 640 × 512 lines
Band width: More than 18MHz
User Controls: Brightness, V-hold, H-hold, V-size, H-size, V-position, H-position, power on/off
Price: £370 + VAT
Review copy from: Technomatic, 15 Burnley Road, London NW10 1ED.

Product: Sanyo 12in green screen monitor DM8112CX
Manufacturer: Sanyo Marubeni, Japan
Purpose: High-performance data display monitor
Dimensions: 320 × 324 × 272mm
Weight: 8kg
Resolution: 850 × 750 lines
Band width: More than 18MHz
User Controls: Contrast, brightness, V-hold, H-hold, V-linearity, height, power on/off
Price: £99 + VAT
Review copy from: Technomatic, 15 Burnley Road, London NW10 1ED.

OVERALL PERFORMANCE

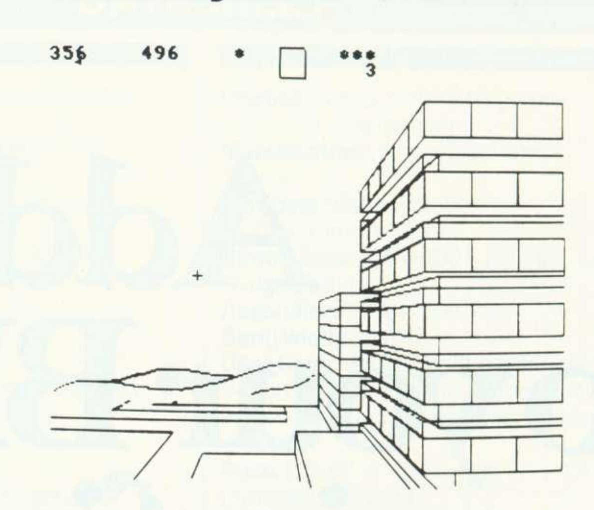
MONITOR TEST	NOVEX 1414	KAGA VISION 3	SANYO DM8112CX	NOVEX 12/500MG
A	**	*****	*****	*****
B	**	*****	*****	*****
C	***	****	***	****
D	***	*****	*****	*****
E	****	**	*****	****
F	*****	****	*****	*****
G	**	*****	***	****
H	****	*****	***	**
I	****	*****	***	***

KEY

EXCELLENT	*****
GOOD	****
SATISFACTORY	***
POOR	**
VERY BAD	*

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and show the true potential of your machine

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Draw points, lines, rectangles ellipses and circles
Smooth curves
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Hidden line removal
Draw in perspective
Measure scaled distances
Ekta sketch lines, Half tone facility
Mirror images
Repeat images, SS, enlarged, reduced, stretched
Actual colour displayed
Store up to 10 ellipses or circles in memory
Redraw any one of these at cursor position
Change any actual colour for one of 8 others
Clear screen, load screen, save screen
Print characters or numbers at any pixel point
Error messages for incorrect input
Fully comprehensive manual





This programme has been purpose designed by professional Graphic Designers for simplicity and ease of use, and is undoubtedly the most versatile drawing programme on the market at this time. There is no need to input any numerical data, as all judgements are made visually. The BBC Micro is the finest drawing machine in its price range. Find out what it can do.

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Diary & RAM Filing System
for the BBC Microcomputer

"The RTC+RAM provides a fast and efficient Diary and RAM filing system that is particularly simple to use."
Acorn User, April 1984.

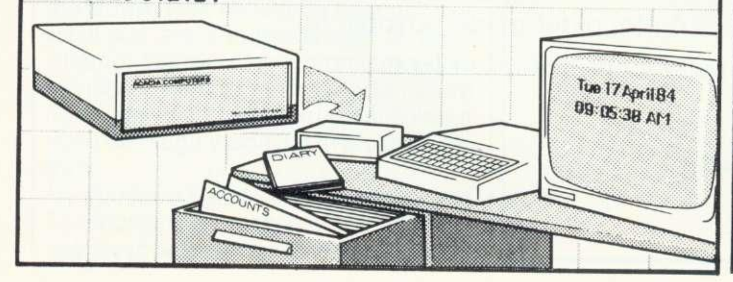
The Diary is sophisticated, yet simple to use appointments' storage and retrieval system with unique features:
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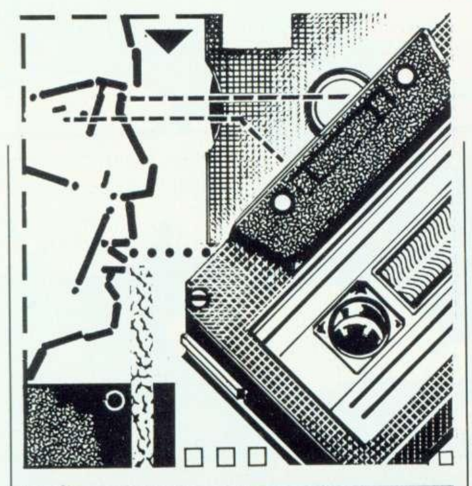
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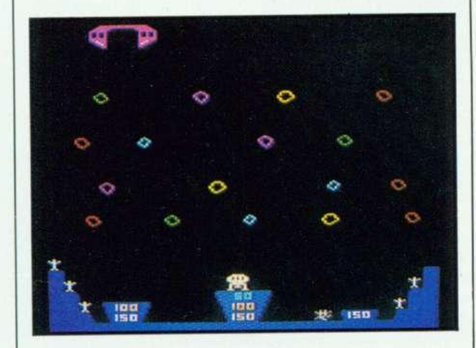
MANY A SLIP 'TWIXT MOON AND MOTHER SHIP

'Lunar Rescue', Alligata Software, BBC B and Electron £7.95

I WONDERED at first whether I had the right game – the cassette cover said *Lunar Rescue*, but all references within the game were to *Space Rescue*.

Whatever its name, the game at first appears like many others in concept, but as you play it you begin to appreciate the differences that add to its appeal.

You start off in the mother ship at the top of the screen, and the object is to rescue six men stranded on the planet below. You release from the mother ship, manoeuvre your way down and try to land on one of three pads. Sounds easy until you realise there are four rows of asteroids moving across the screen in different



directions, and you must avoid them at all cost.

If you land on a pad without crashing into it or any of the asteroids you get bonus points according to the rating of the pad. That level on the pad is then removed, so it becomes smaller and more difficult to land on at your next attempt – and the bonus points higher. Once you're down one of the men runs across the screen and into your ship – a very pleasing effect. Your ship takes off automatically but to your horror the asteroids change into rows of alien ships which immediately start dropping nasty things on you. You can fire back at them but you have to concentrate on dodging them to reach the mother ship.

Your troubles are not over if you do get through. When you break through, the mother ship stops and opens its door and you have to manoeuvre inside. If you haven't reached a suitable position you will crash into the ship and lose a life or hit the top of the screen, at which point your little man plummets to the surface, never to be seen again.

You repeat the process for each of the six men and are rewarded with bonus points if you rescue them all. If you reach 3000 points you get an extra rescue ship. You continue until you run out of fuel or you lose your three lives, which isn't difficult.

Your controls are Z and X for left and right, and a nice additional feature is the multi-use of the return key. It releases you from the mother ship and also slows down your descent (which unfortunately uses up fuel). You use it to fire at the aliens as you go up, and your ascent speeds up if you keep your finger on the button. A pity that a game as good as this doesn't provide for joysticks.

Resolution and speed of graphics is good and the sounds are appropriate. The game requires great concentration and dexterity. It is good value for money and if you like action sufficiently different to make it worth buying.

Ian Rowlings

PUSHING AND SHOVELLING

'JCB Digger', Acornsoft, BBC B, £9.95 (disc £11.50)

ANY game that promises a mixture of *Monsters* and *Snapper*, with the originality of driving a JCB earth-moving digger around an island, and written by Acornsoft, sounds like a real winner.

The screen display of *JCB Digger* is a window on part of the island's landscape and the JCB is in view at all times. The vehicle can be moved in the standard four directions – up/down, left/right. Viewed from the side, the JCB has two main moving parts, a shovel/hopper at the front that fills in holes and clears earth and other obstructions, and a mechanical digger arm at the rear. These movements can be controlled by two further keys or by joystick.

The aim of the game is to drive the JCB around the landscape, clearing it of various obstructions such as earth and trees (not a game for conservationists). There's one little problem, however. The meanies! These are circular floating monsters who, if they catch up with you, will push you out of the driving cab and drive the digger away. So, your task is to clear the landscape and kill the meanies. They can be killed by digging holes (though you are limited by the number you can dig) and hoping a monster falls in and then filling in the hole (surely this idea has been used before?). Or you can catch a monster on the front of the digger when the shovel is down and push it into the sea and drown it. You have three lives and with succeeding screens the monsters change colour and the difficulty level increases.

JCB Digger is supplied on cassette or disc and there are the usual options of a pause facility and turning the sound off –



something you'll probably want to do quite quickly as the sound effects, though well-executed, become annoying especially as clearing a screen takes a long time.

I found *JCB* disappointing for a number of reasons. First and foremost, the 'shudder' on the screen is irritating. Hardware screen scrolling is used in all directions, as there is a lot of landscape to get round, and when you move vertically the top and bottom lines of the screen flash and jump. If a monster catches you, the driver jumps out and the monster drives the digger off-screen. The problem is, an after-image of the driver stays in the cab.

The idea behind *JCB* is novel, but in the final analysis lacks the punch of previous offerings from Acornsoft. The idea is not done justice by the screen display. Too much has been sacrificed to achieve a landscape scroll in all directions and the final product is not of the quality we have come to expect from Acornsoft and Jonathan Griffiths, who also wrote *Snapper*.

JCB held little interest for me, though there might be some who will like it purely for its new approach to chase-the-monster and eat-the-dots.

Dee Vince

GHOULS AND JEWELS

'Ghouls', Micro Power, BBC B, £7.95

GHOULS is a delightful game set in a mansion on top of a creepy hill. There are said to be 'power jewels' inside, but all those who have gone in search of them have fallen victim to the mansion's deadly inhabitants.

The mansion has four sections. First you must traverse Spectre's lair, on through Horrid Hall, into the Spider's

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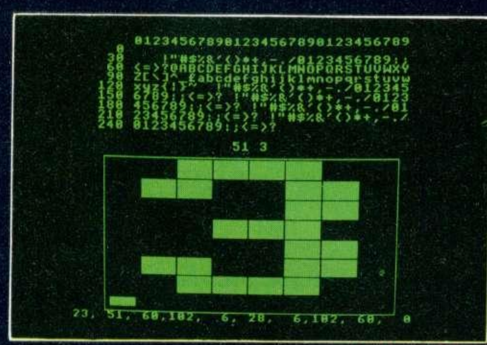
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The above list is only a fraction of the commands in the PRINTMASTER ROM. Others include ★CENTRE, ★UNDERLINE, ★ITALIC, ★MARGIN etc. etc. which provide total control over the printer. Order as PRINTMASTER (Epson).

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parlour and finally to Death Tower. Each one must be finished before your time runs out.

Each section has defences, however – poison-tipped spikes that you must jump over and a ghost that follows you. The spider, which guards her parlour, bounces up and down and you have to dodge beneath her. Worse still are the moving platforms and disappearing floorboards. On some levels, you use powerful springs to bounce from floor to floor. You are not without defences, though. If you can eat a stray power jewel, the ghosts will disappear for about 15 seconds.

The graphic quality of *Ghouls* is impressive, despite being fairly straightforward. I liked the sideways scrolling after each level (as described in April's *Acorn User*) and the way the screens are displayed, but some of the movement is jerky. The funniest aspect of the game is the way your character moves, complete with the pitter-patter of tiny feet, though I was concentrating more on that spider.

Sound can make or break a game, and the sound in *Ghouls* is superb. Some of the noises are creepy, and would be well-placed in a horror film! You can even have music playing while the tape loads.

The program includes a top-ten scores table, and you can pause while you brew your tea. Controlling your men (you start with four) is simple, using Z, X to move and 'Return' to jump. The game itself is not so easy!



Ghouls is a great game with superb sound, fair graphics and enough problems to keep the player trying.

Stuart Menges

DOTS & CRASHES

'Dodg'em', Microgame Simulations, BBC B, £00 (disc £00)

MY FIRST reaction to Dodg'em was 'I've seen this somewhere before'. Sure enough, it is a faithful reproduction of an arcade game popular a couple of years ago.

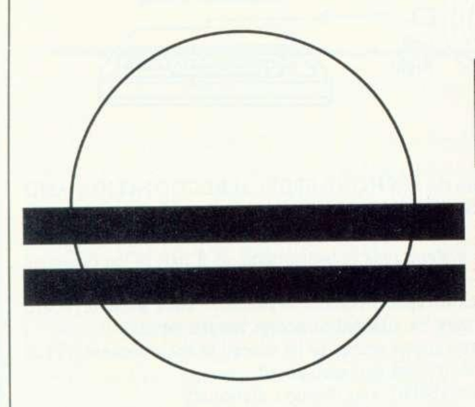
It's simple in concept if not easy to win. The aim is to move your car around a four-lane track covering as many red dots as possible and jumping from lane to lane to do so. The computer car is also swapping lanes and trying to crash into you. Fortunately, when you jump you cover two lanes whereas the computer car jumps only one. You can also accelerate out of danger – or into it.

You have three lives before the final collision, and your score reflects the number of dots covered. Remove all the dots on one screen and you progress to the next. There are 15 screens, all presumably of the same format, except that as you progress you are confronted by up to three computer cars at once.

The game is compulsive for the masochistic, but the choice of keys seems a little strange – A/Z for up and down and K/L for left and right – still, I expect you get used to it.

The animation is not very fast but then if it were you'd never get past the first screen. Altogether, it's quite a nice game of its type.

Ian Rowlings



DOTTY APPROACH TO DAISYWHEEL

George Hill on the Canon PW1080A NQL and Sanple Daisy Step 2000

WHAT, you may ask is an NLQ printer? Here is another piece of jargon being foisted on the computer public!

NLQ stands for Near Letter Quality.

How near is near? Well I reckon is is *very* near. The Canon PW1080A has very fine dot wires, and produces a somewhat 'dotty' style of print in normal print mode, but the gaps between dots are filled in in NLQ mode, producing a typeface almost indistinguishable from daisywheel print except under a magnifying glass. Only the descenders (tails of the p, g, y etc) betray it. They are limited to two dots' depth but the style is attractive and a considerable improvement on anything I have seen before at the price (£319 + VAT).



At £258.75 the Sanple Daisy Step 2000 may be the cheapest daisywheel available (review model supplied by Kyeaki Ltd)

For me, the beauty of this printer is that its printing control characters and escape sequences are, praise be, identical to the Epson FX80 set, and hence all programs written for the MX or FX80 work perfectly on the Canon. I will not bore you with a repeat of the FX80 review, printed in the October 1983 issue. The more important features shared by the Canon are:

- Full graphics capability, including single, double and quadruple density graphics, CRT graphics (640 dots per line – enough for two dots per pixel in mode 1), 'plotter graphics' (precisely round circles for design work) and nine-pin graphics.
- Extensive 'download character' capability, with full freedom to switch character sets.
- Variety of print styles, including italics, pica and elite, and proportional spacing.
- High speed – 160 characters per second.

How does the Canon differ from the Epson (and its Star competitors)? Let's look at its design features and printing capability.

First, it's smaller and neater than the Epson, and infinitely more convenient to load with paper. The paper feed mechanism has the 'tractor' (the wheels with pins which locate in the fanfold paper to drive it) mounted *before* the roller (figure 1). This mechanism is the same as the Shinwa C80 printer, on sale in WHSmith's. The arrangement allows reverse paper feed without the danger of jamming the paper in totally inaccessible places, a continous source of annoyance with the

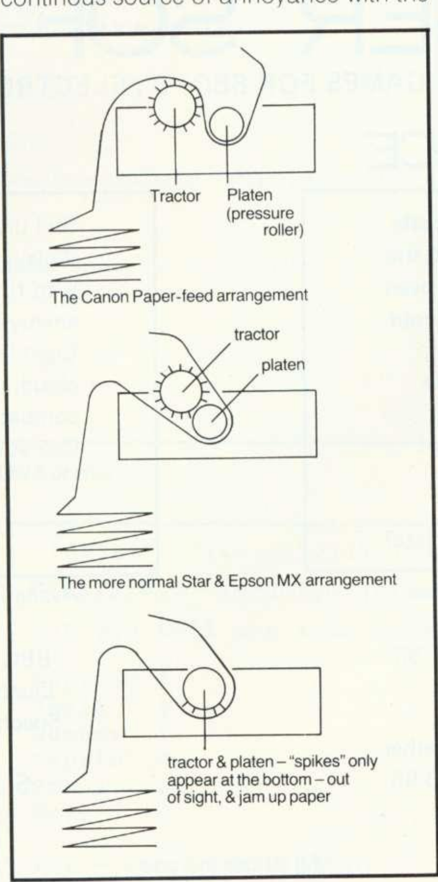


Figure 1. Tractor feed arrangements

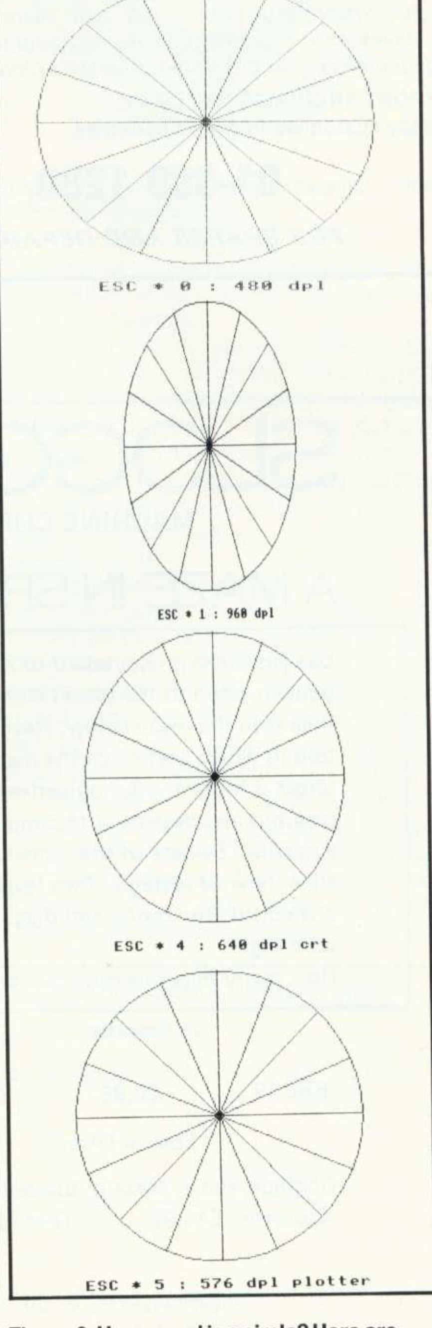


Figure 2. How round is a circle? Here are some ESC * graphics options

FX80 at my college and in the *Acorn User* office.

Second, it has *clear* plastic at the critical point where you want to look at the paper. You can see the print-head without having to remove the cover or raise the lid. These two simple features make it very easy to use.

Third, it has a switch, located behind the tractor feed, which switches off the 'paper-end detector' if you want to change from fan-fold to cut-sheet paper. This saves sending complex escape sequences and resetting internal DIP switches.

Now the extra goodies in terms of printing capabilities. NLQ printing is produced by printing the patterns for a line of letters, then performing a 'half-dot' paper feed, returning the carriage, and printing a second pattern which neatly fills in the gaps. Printing by this method is, of course, much slower than normal – the 160 cps is reduced to 27 cps, pretty slow but still much faster than competitively priced daisywheels.

There is a graphics capability to match the NLQ printing mode, and an NLQ download character set, giving you a massive 16x23 matrix of dots to define for each character.

I regret that I never had the patience to test this facility!

There is a 'character at a time' printing capability, which allows the Canon to be used like a typewriter, though my brief experiments seemed to generate an inordinate number of reverse paper movements.

I detected a serious bug in the horizontal tab function. After sending ESC "D", followed by a list of the column numbers, terminated by 0, the tab-stops are set at the column positions specified by the parameters. If, however, the column numbers are 'printing characters' – eg, 50, 60, 70 in my program – they get printed. This accounts for the spurious appearance of 2 (CHR$50), < (CHR$60) and F (CHR$70) in the tab line on the test routine.

The manual is a beautifully produced model of clarity. It is laid out along the same lines as the Epson FX80 manual. The only significant lack seems to be an alphabetical index.

The daisywheel competitor costs under £300, and is a full-size printer that, like the Juki, will take A4 paper sideways. It uses a Qume-style ribbon cartridge and Qume-compatible wheels which are expensive but freely available.

The printing capabilities of the Sanple Daisy Step 2000 are limited, but I doubt if most users would require the more advanced features. The most notable omission from the repertoire is proportional spacing. There's bold, shadow and underline printing for highlighting and the usual margin settings and tabbing arrangements.

Daisywheel printers seem unable to recognise paper widths, so you really have to set the margins every time you use the printer, by escape sequences (no DIP switch control), or use the WIDTH command from computer or word processor. At least, though, the margin setting is not at 'current carriage position' as in the Juki.

Close control of paper movement makes graphics printing possible, though the method differs from that suggested for the Juki. I suspect the dump routine (program 1) is more likely to prove generally applicable to daisywheels than

CANON
prints
FABFACE

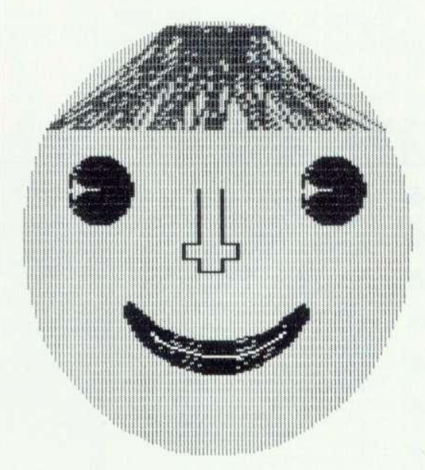


Figure 3. Face printed by 'Epatall' – the all-mode Epson dump

```
Normal character set.

!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
qrstuvwxyz{¦}~

Italic character set.

!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
qrstuvwxyz{¦}~

NLQ  character set.

!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnop
qrstuvwxyz{¦}~

This is in NLQ style.
and this is NLQ with proportional spacing.
This is NLQ enlarged with
and without proportional spacing.
Italics and standard in elite style
Italics and standard in proportional spacing

Now for the editors benefit the elloneohzero test.
Il1-OØo  Il1-OØo

This illustrates the TAB function and its bug.

01234567890123456789012345678901234567890123456789012345678901234567890123456789
(2<F^POS0              ^POS20                  ^POS50

Any word or letter may be underlined in any style

All types of print and graphics ▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲▲  can  be mixed on one line

Subscripts ,superscripts and download characters

2NaOH + H2SO4 → Na2SO4 + 2H2O

N2 + 3H2 ⇌ 2NH3

(a + b)2 = a2 + 2ab + b2
```

Figure 4. Example text printed on a Canon PW1080A printer

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRST
UVWXYZ[®]©_°abcdefghijklmnopqrstuvwxyz§¶†™
Can you tell one from lower-case ell and oh from zero ?

Capital I
Small   l
Number  1
Capital O
Small   o
Zero    0

Ill - OOo 101010101010
```

Figure 5. Sanple character set and the 'ello 'ello 'ello test

the Juki dump printed in the January issue. It uses ESC HS(31) to control horizontal paper movement and ESC US(30) to control vertical movement, and prints a full stop for a dot, and a space for no dot.

I found annoying the fact that the printer was off line when switched on, and needed a touch on the switch panel before it would operate. There's a 'set page' button on the front panel to set 'top of form' at the current paper position.

The Qume Courier 10 print-wheel supplied has some curious features; there are, for example, strange characters in some of the ASCII punctuation positions, l and 1 are indistinguishable, and numbers are bigger than letters. Friction feed is the only option at present, though tractor and cut-sheet feeder attachments, also at reasonable prices, are on their way.

The manual is a tatty multi-language document, of which only 20 pages are in English, and several of those are about esoteric details of interfacing. If all the translations are as bad as the English, there will be some confused users around the world. No programs, and not much help.

By any standards 18 cps is slow, but if you must have a daisywheel printer for business use, this is the cheapest I have yet seen, and is perfectly adequate.


```
  10 MODE2
  20 PROCCENTRE("SANPLE daisy step",6)
  30 FOR I=1 TO 7
  40 PROCCIRCLE(80+80*I,150+50*I,60*I,I)
  50 NEXT
  60 FOR I=6 TO 1 STEP -1
  70 PROCCIRCLE(640+80*(7-I),500+50*(7-I),60*I,I)
  80 NEXT
  90 PROCDUMP
 100 END
 110
 120 DEFPROCCIRCLE(X,Y,R,C)
 130 GCOL0,C
 140 MOVE X+R,Y
 150 FOR th=0 TO 360 STEP 8
 160 X1=X+R*COS(th*PI/180)
 170 Y1=Y+R*SIN(th*PI/180)
 180 DRAW X1,Y1
 190 NEXT
 200 ENDPROC
 210
 220 DEFPROCCENTRE(T$,C)
 230 COLOURC
 240 PRINTTAB(10-INT(0.5*LENT$),1)T$
 250 COLOUR 3
 260 ENDPROC
 270
1000 REM SANDUMP
1010 REM G.B.Hill (C) 1983
1020 REM dump for the SANPLE daisy step 2000
1030 DEFPROCDUMP
1040 REM Enable printer
1050 VDU2,1,13,1,13,1,13
1060 REM ESC US 3 to set horizontal spacing
1070 VDU1,27,1,31,1,3
1080 REM ESC RS 1 to set linefeed
1090 VDU1,27,1,30,1,2
1100 FOR Y%=1023 TO 0 STEP -4
1110 FOR X%=0 TO 1279 STEP 4
1120 IF POINT(X%,Y%)>0 THEN VDU1,46 ELSE VDU1,32
1130 NEXT
1140 REM Linefeed
1150 VDU1,13
1160 NEXT
1170 REM Reset printer, disable and beep
1180 VDU1,27,1,30,1,9,1,27,1,31,1,13,3,7
1190 ENDPROC
```

Program 1. A graphics routine and dump for the Sanple and other daisywheels

page 151 ►

MAKING A HASH — PRINTING A POUND

WE get a number of queries about the possibility of printing the # and £ signs in the same piece of text. This can be accomplished in a number of different ways. The normal arrangement for dot matrix printers is to have the printer supplied with the £ sign printing as character 35. The first thing I do when taking delivery of a printer is to change the DIP switches from the English character set to the USA set. This gives me # and $ signs as on the keyboard. However I have not yet found a printer that gives me the £ sign as character 96 (the value given by the £ key on the Beeb).

What to do? There are a number of possibilities.

1. If you have download characters, then re-define character 96 to be the £ sign, and all will be well. The codes to do this on the FX80 and Canon are in program 2. Run program 2 as a start-up option whenever word processing is to be undertaken.

2. You can, within a word processing environment, normally send escape sequences. The series of codes to cause a switch from # to £ is as follows:

ESC "R" 3 (switch to UK)
35 (# character code)
ESC "R" 0 (switch back to USA)

If you have decided to leave the UK character set active, then the sequence to obtain the # would be:

ESC "R" 0 35 ESC "R" 3

3. On some printers (the Seikosha, FX80 and Canon, for example) the extra characters can be printed by codes greater than 128. On the FX80 and Canon the code is 134, after the full character set has been copied into RAM.

4. Method 2 may be applied on some daisywheels, depending on the wheel. The Juki wheel allows international character-set switching. The Sanple and Qume wheels generally do not, though the ESA wheel does have both symbols, but you loose many others, including < >.

A knotty problem, and you have to work out which solution suits you best. At worst, you can always print a space, and write in the missing symbol.

```
 10 REM Enable printer
 20 VDU2
 30 REM Copy ROM characters into RAM
 40 VDU1,27,1,ASC":",1,0,1,0,1,0
 50 REM Select RAM characters
 60 VDU1,27,1,ASC"%",1,1,1,0
 70 REM Redefine character 96
 80 VDU1,27,1,ASC"&",1,0,1,96,1,96
 90 REM Send codes for pound sign
100 VDU1,138,1,18,1,0,1,126,1,128,1,18,1,128,1,18,1,128,1,66,1,0,1,0
110 REM Disable printer
120 VDU3
```

```
RUN
PRINTCHR$35;CHR$96;"#£#£#£"
#£#£#£#£
```

Program 2 and RUN. Sets up the £ key to print the £ sign on the FX80 or Canon PW1080A printer



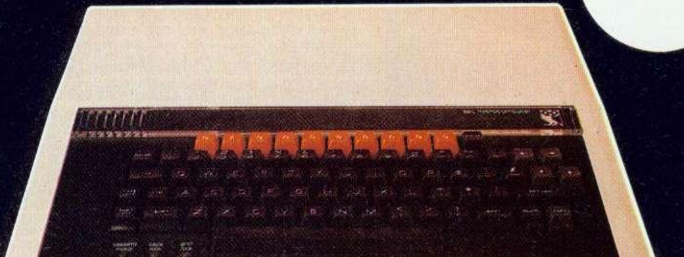
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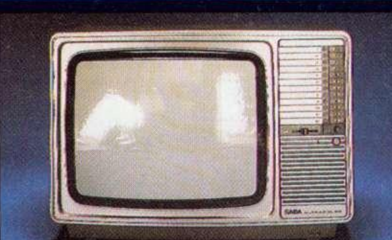
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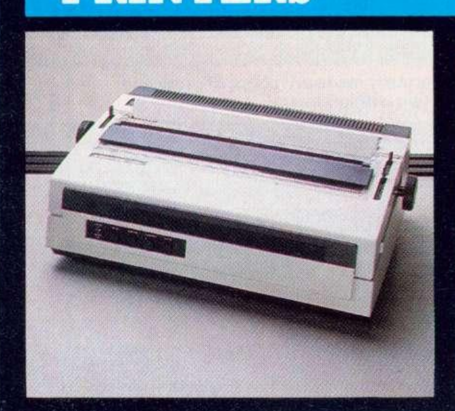
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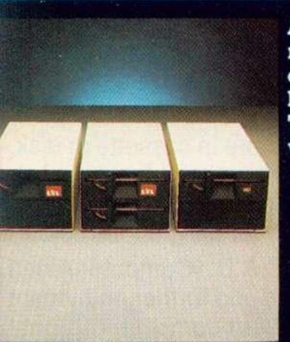
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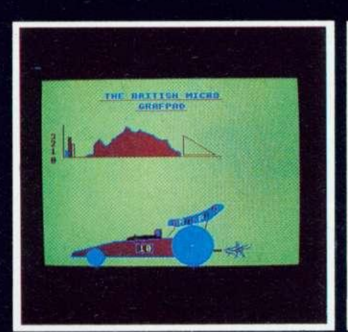
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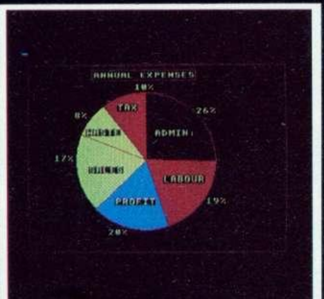
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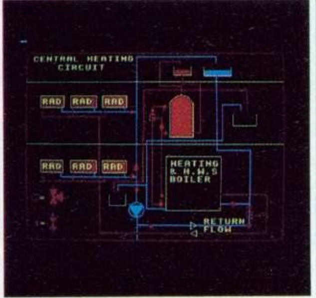
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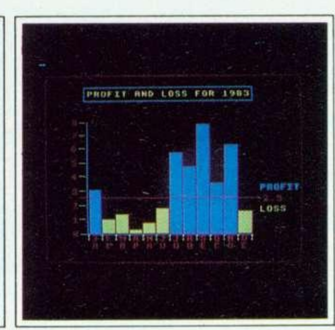
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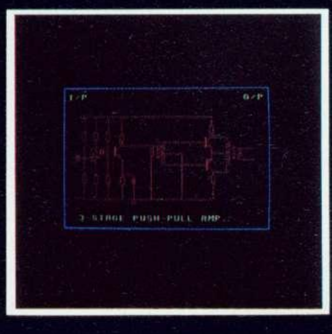
(Size: 25mm height x 55mm width x 260mm depth)
Weight: 1.2 kg (Gross)

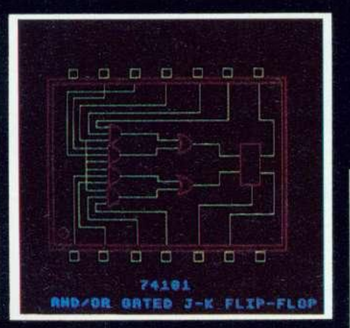












(The above designs were drawn by a 12-year-old at our showrooms!)

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SANPLE

daisy step

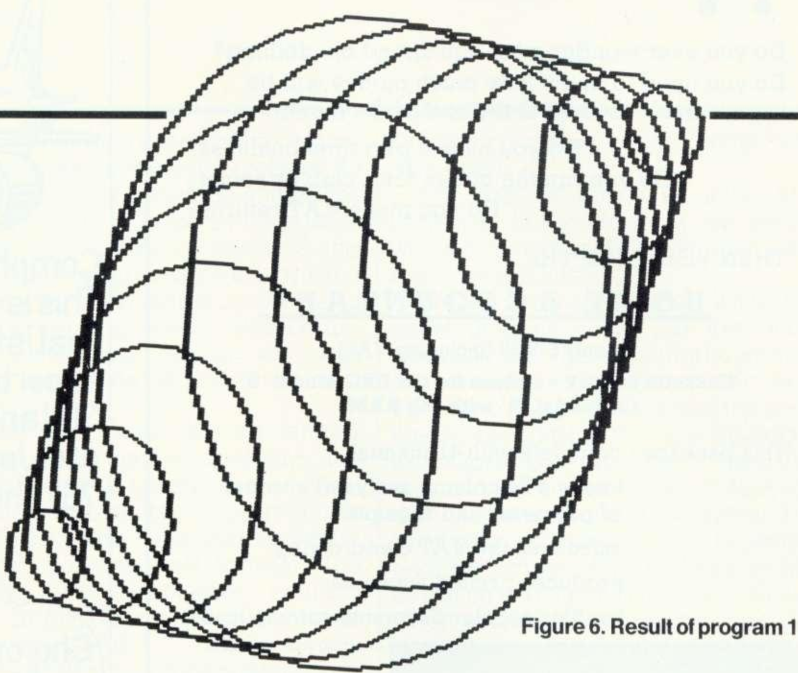


Figure 6. Result of program 1

STOP WATCH ON PRINTERS

HELP US COMPILE A LEAGUE TABLE

MANUFACTURERS are invariably over-optimistic about the speed at which their printers will operate. When you buy a printer with a quoted speed of, say, 160 characters per second (cps) what does this mean? Normally it is based on the maximum speed that the printer is capable of, with no linefeeds and, in the case of daisywheel printers, no letter changes. These conditions are simply unreal. I am interested in compiling a league table of printer performance.

Program 3 is a short test routine which prints 25 lines of 80 characters. I have chosen two characters (∗x) with ASCII codes fairly widely separated to give more realistic results with daisywheel printers, where character switching is mechanical and therefore slow.

The procedure is analogous to the PCW Benchmark programs for testing computer performance. You need a stopwatch to time the printer. I tried a program using the TIME function on the BBC, but the results are grossly distorted by the different buffer sizes of the printers. A large buffer results in almost instant transfer of information to the printer and so gives a big advantage, making the micro available for other purposes. Here, however, we are interested in how rapidly the printer actually prints! The method is as follows:

1. Run the program, starting the stopwatch on the first beep from the printer, or the printing of the first ∗.
2. Stop the stopwatch when the second beep is heard from the printer, or when the final x is printed.
3. Record the time taken.
4. Calculate the speed by the formula 'speed = 2000/time'.

Results for the Star Delta 10 (reviewed in the April issue), Canon PW1080A and the Sanple Daisy Step 2000 are shown in the panel.

Readers are asked to send results for other printers. Address them to 'Benchmark', *Acorn User*, 68 Long Acre, London WC2. All we need to know is:

1. Name and address.
2. The maker's name and the model number of the printer.
3. The manufacturer's quoted speed from the manual or the advertising.
4. The printout produced by running the Benchmark program (program 3).
5. The time taken, and your calculated value of the speed in cps.

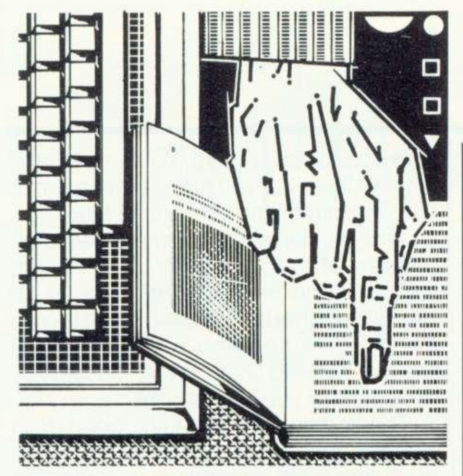
Please don't send in your results in the form of a long letter!

```
 10 REM Printer Benchmark
 20 REM Time taken to print
    25 rows of 80 characters
 30 VDU2,1,7,1,13
 40 FOR I=1 TO 25
 50 FOR J=1 TO 40
 60 VDU1,42,1,120
 70 NEXT
 80 VDU1,13
 90 NEXT
100 VDU1,7,1,13,3
```

Program 3. Benchmark test routine for printers

PRINTERS' REAL TIME

MAKER	MODEL	MODE	advertised speed (cps)	time (BM)	cps (BM)
Canon	PW1080A	normal	160	20.00	100.0
		NLQ	27	77.75	25.7
Sanple	D/S 2000	normal	18	190.95	10.5
Star	Delta 10	normal	160	20.69	96.7



KEEP YOUR MICRO GUESSING

'Micropuzzles' by J J Clessa (Pan, £2.95), 'Brainteasers for the BBC and Electron Computers' by G Ludinski (Phoenix, £5.95) and '101 Puzzles to Solve on your Home Computer' by Andrew Hilton (Harrap, £4.95)

THESE three books provide a good cross-section, both in state-of-the-art puzzle books and in computer book publishing. In no case does the price of the book generally provide any accurate guide to the quality of the contents. I shall begin with the least expensive and work upwards.

Micropuzzles is part of the Pan *PCN* Library – a series launched fairly disastrously last autumn. Since then two titles have had to be pulped because of the extraordinary number of errors and no-one is very happy with what's left. *Micropuzzles* is probably the best of a bad bunch. It consists of a straight reprint of the puzzles set by J J Clessa over the years in the 'Leisure Lines' feature of *Personal Computer World.*

You get 144 pages for your money. The first part of the book consists of 70 'quickies' – so named because you are expected to solve them in your head or employ a little lateral thinking. Most of them are rather well known – eg, 'What weighs more, a pound of feathers or a pound of gold?', a puzzle I recall reading in *Reader's Digest* when I was about six – and who knows where they got it from? I cannot see the point of including this sort of thing in a 'computer library', unless, that is, you need to pad out the book.

For the record, there are 60 puzzles that are soluble by computer, though in several cases the author says that doing it logically with pen and paper is more efficient! One hopes that Pan, arguably the most impressive and professional of UK paperback houses in most areas, will take rapid steps towards improvement.

101 Puzzles to Solve On Your Microcomputer is the best-produced of this trio. It has the largest format of the three – A4 size – and each question is accompanied by a cartoon. A nice touch is the spiral binding, which enables the reader to leave the book lying open while constructing a program to solve the problem. If I have a criticism it is that the author has found it difficult to make all his puzzles original: he ingeniously sidesteps this point by dedicating the book to Lloyd and Dudeney, the most creative people ever to construct puzzles. And, it must be admitted, coming up with 101 new ideas would stretch the ingenuity of most people.

It's no coincidence that the famous problem about the five castaways, the monkey and the coconuts – an ideal problem for a computer – appears both in Clessa's book and in this one. Still, they're in good company. Last summer, *The Sunday Times* Brainteaser, normally rather an original source of intellectual stimulation, used it.

Andrew Hilton has done a good job in sorting his puzzles into number-crunchers, problems involving the use of nine or ten different digits once only, exercises in probability and codes and ciphers. His book probably represents the best value for money of all three.

Brainteasers at £5.95 is the most expensive; it's author claims to specialise in marketing educational software. Instead of a series of puzzles with answers at the back, this book consists of a series of games that you type in from a listing of a Basic program. The publishers have sensibly printed the listings directly rather than entrust them to a typesetter, but they used a cheap printer, so the result is messy and difficult to read.

The games are the kind that interests people new to the excitement of computers, but most of us grow tired of this sort of thing within a couple of months. In fact, most *Acorn User* readers would be likely to spend more time fathoming out the listings and typing them in than in actually using the software. Still, the enthusiast can save the trouble by sending another £6.95 to the publishers and getting a cassette of the programs. At twice the price of the Pan book, and the same number of pages, this book is really a bit expensive. **Simon Dally**

TEACHING YOUR MICRO TO PLAY

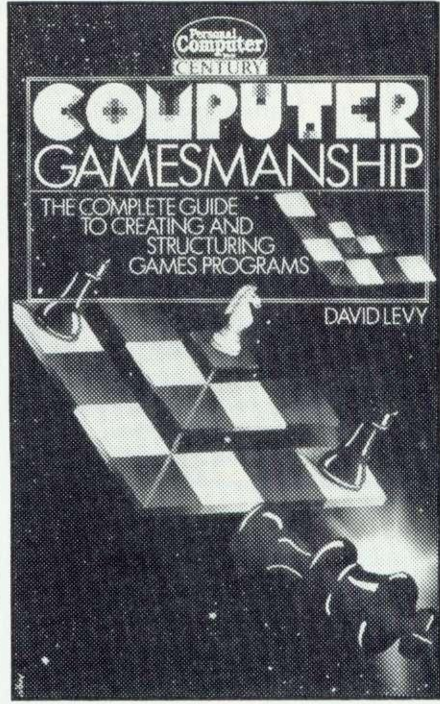
Computer Gamesmanship by David Levy, PCW/Century, 272pp, £7.95.

THIS book is actually a collection of articles written in 1980/81 for *PCW* magazine, presented in 18 chapters. It is fairly comprehensive, the first seven chapters covering the fundamental programming techniques involved in games and various enhancements. The final chapters cover specific games (draughts, chess, backgammon, stud poker, draw poker, Othello, go-moku, bridge, shogi and dominoes).

The style of writing is active and interesting but there are a few places where time and care should have been used in explanations.

Anyone wishing to write an 'intelligent' game program could use this book. Obviously, every game cannot be covered as thoroughly as in other specific texts, but here in one paperback is all the basic theory, and some of the more advanced techniques. Levy also gives many references to other specific texts, in case you wish to develop your program further. The book may also serve to help beginners decide which sort of game to attempt first, by stating the relative difficulties of each.

Initial chapters tackle minimax tree

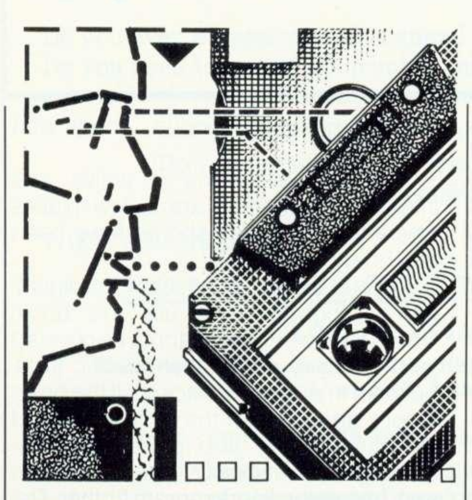


searching for game trees, including the many enhancements such as alpha-beta pruning, move-ordering, the killer heuristic and windowing. The book then continues to explain how to design simple or complex evaluation functions and how to quantify and weight the various relevant factors. It also goes into some algorithms which allow your program to learn, and thus, hopefully, improve its play.

Card game basics are covered, including the relevant probability theory, deducing information from bidding and actual play, expected value trees, psychology and bluffing.

The chapter on Samuels' draughts program is rather bare, considering it was the first to play at a world class standard. Also the awkward data structures in draughts are not mentioned in any way. Chess has the largest coverage, with some interesting game annotations I

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PRISONER OF ZANDOR

'Lost City', Superior Software, BBC B (32k), £7.95

LOST CITY is an almost text-only adventure, in which you have to find the Lost Diamond of Zandor.

Many years ago, Ikan Findem (geddit?), a well-known explorer, set off on an epic quest to find the legendary diamond. For many years he searched, until, one day, he was found in a hot, desolate valley. His dying words were: 'I have found the Lost City'. Anyone who tried to find it was welcome to his equipment.

You are parachuted into the valley and this is where your search begins.

Playing the game is enjoyable, but I found it frustrating as I couldn't get out of the valley – can anyone help?

The function keys have been set up with commands such as North, Lake, Look, List and Help. This last command can be useful in certain locations, but normally lists the key definitions.

Colour has been well used. In mode 7 there are one or two pictures, and the text is colour-coded according to message type. The messages are put across in a helpful way, too. I felt at ease during my short games – it's just that I'm totally stuck, and you get unexpected messages now and then.

There appears to be no 'save-game' facility in *Lost City*. This would have been useful, particularly in my predicament! That aside, though, the adventure is good, with a fair number of locations (I looked at the listing!). I have to say, however, that at £7.95 *Lost City* is overpriced compared to masterpieces like the original *Colossal Caves*.

Stuart Menges

COLDITZ DODDLE

'Colditz Adventure', Superior Software, BBC B (32k), £7.95

THIS is one of the simplest adventure games I have ever experienced. It took me just over one hour, including mapping time, to complete it.

The idea of *Colditz Adventure* is to escape from the castle with certain objects vital for survival. You can escape without them but you die by getting lost or starving or meeting some other fate.

The 'problems' I encountered were no problem and required little or no thought to solve. The messages give you such heavy hints that it would be difficult to miss the point. You may have to run through the plot twice to finish, but if, like me, you are cautious you'll be all right.

The screen layout is fairly good. You are told where you can go (in the nicest way) and each direction is in a different colour. Directions may be entered as single letters, although you don't seem to be able to abbreviate nouns. Another niggle is that words were chopped up when a line was full – even IS was split on one occasion.

The screen is quickly cleared and updated after every move, a nice touch which keeps everything neat.

There's a 'save game' facility but I don't think it will be needed. The routine to save is very quick; there are only about 35 things to read or write.

Apart from one or two spelling mistakes the program is well-written in Basic and response is fairly quick. A bit of thought could have reduced the size of the program a little. However, for the Basic adventure writer there are a few good routines here.

To sum up: good for beginners or programmers, but a little too simple, and it should be more user-friendly.

Stuart Menges

◀ *page 153*

hadn't seen elsewhere. All the major stages in computer chess development are mentioned. The backgammon chapter is now rather outdated as Berliner's program BKG 9.0 won the world championship after the articles were written. (This program has been the subject of an article in *Scientific American* which is better than Levy's chapter.)

Stud and draw poker are covered in an interesting way, although once again, Levy mentions some problems with the 'bluff' aspect, but fails to suggest any real solutions. However, I'm sure these two chapters would help many people write good poker programs. Othello is given a good airing, and many people who have not written any strategy games programs before may find this an ideal start. The go-moku suggestions are reasonable but not really adequate. The game is easy to program for legal play, but very difficult for strong play. The two bridge chapters (one on bidding, one on play) seem very inconcise. This is probably because the game is, as stated, very difficult to program well.

Shogi is covered in the best way – referral to other more detailed texts! This game of Japanese chess is probably totally alien to most British people and so it would be very difficult to say the best way to program it. I imagine anybody who seriously attempted writing a shogi program would soon become one of the experts in the western world, with more being learnt from experience than from Levy's chapter.

Finally, dominoes is given a thorough computer strategy, fairly easy to program, which as Levy states, if used 'would probably produce a program of world championship calibre!'

A lot of development work has been done over the past three years in the field of artificial intelligence in games programs and so the book is certainly lagging behind in several aspects. I would have preferred to see some changes to the original articles to reflect the latest major developments.

Still, the book is quite good value for £7.95. **Martin Bryant**

BASIC ABC

'BBC Basic for Beginners' by David Smith, Melbourne House, 315 pages, £6.95

BEARING in mind the complexity of the BBC micro and its wide appeal, the *BBC User Guide* cannot meet the needs and abilities of all potential buyers. And this is where David Smith's book comes in, for it is clearly aimed at those who find the *User Guide* difficult and daunting, particularly those who are new to computing.

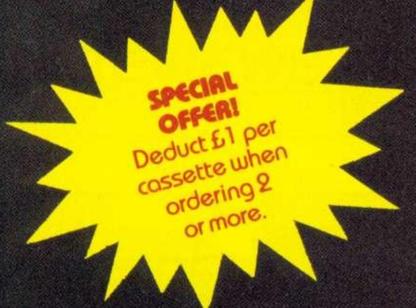
BBC Basic for Beginners is divided into three sections. Section A covers the bare essentials of BBC Basic needed to write elementary programs; section B deals with more advanced facilities and programming constructs (eg, sound, procedures and arrays etc), and the final section tackles weighty areas such as the teletext mode, user-defined characters, error-handling and data-files.

Each chapter is interspersed with exercises or more lengthy projects to consolidate the topics covered, with model answers at the end of the book.

On the whole, this is a well-paced introduction, with a clear and thorough style. The later chapters cover topics which even supposedly advanced volumes tend to omit (for example, random access file handling), and should provide a useful source of development material once the basics have been absorbed.

So, if you're still struggling with the *User Guide* that you got with your Christmas Beeb, the gentler introduction of *BBC Basic for Beginners* is just the sort of book you need.

Vincent Fojut



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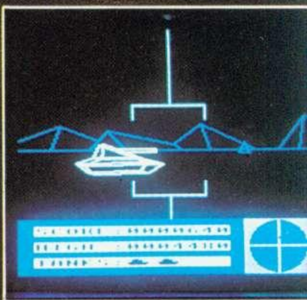




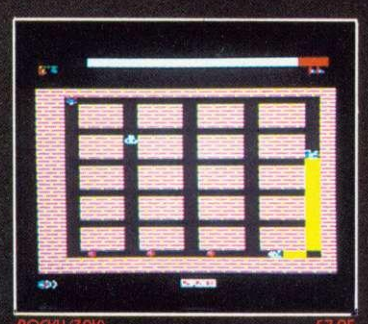
BORIS IN THE UNDERWORLD (32K) £7.95
A novel arcade-style game in which you take the part of Boris, who has had his home raided by the underworld creatures. They have stolen most of your possessions and your task is to venture into the underworld to retrieve your valuables by fighting off the underworld creatures. The walls of the underworld close in and you will be vapourised if they touch you. Can you retrieve all of Boris's possessions from the underworld?
●●●NEW RELEASE●●●



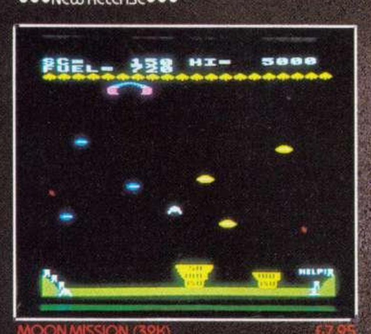
OVERDRIVE (32K) £7.95
A highly-addictive multi-stage 3D race game. You steer your car left and right, accelerate and decelerate as the opposing cars weave about the road. There are five different stages including night, snow, desert, and riverside scenes. Incredible graphics give the impression that you really are taking part in the race. Highly recommended, and destined to become another top-seller for Superior Software.
●●●NEW RELEASE●●●



BATTLETANK (32K)
An excellent game, made possible on the computer only by the unique use of a dual-sc display and specially written plotting rout You are a tank gunner looking out onto a mou plateau. You see the distant mountains and pyramid obstacles – and also the enemy Position the tank in the rectangular viewfind fine adjustments of your controls...then fire! (KEYBOARD or JOYSTICKS).
●●●NEW RELEASE●●●

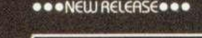


ROCKY (32K) £7.95
A new concept in arcade-style games. Your task is to save yourself from patrols of mutant robots by dropping rocks on them. Each of the robots has a single large eye which emits a yellow beam of light. Being caught in this beam reduces your strength and, if you are not carrying a rock, causes the robot to metamorphose. It may change into either a spectre or a cruncher.
(KEYBOARD or JOYSTICKS)
●●●NEW RELEASE●●●



MOON MISSION (32K) £7.95
Moon Mission is a fast-action machine-code game featuring superb graphics, sound effects, hi-score, and rankings. Your mission is to rescue the six astronauts stranded on the moon by steering your spaceship through the meteors and space-mines. The game starts relatively slowly, but from sheet to sheet not only does the speed increase, but also the number of meteors, space-mines, enemy spaceships, and fireballs.
●●●NEW RELEASE●●●



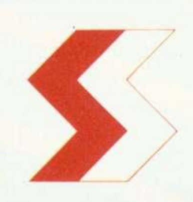


2002 (32K)
A space docking simulator using 3D graphi model the motions and responses of the OR spacecraft. Your mission is to pilot the shuttl "soft dock" with the space station. PITCH, ROLL, FORWARD, LATERAL and VERTICAL en are provided together with orbit manoeuv booster engines. 6 skill levels provide fo completely inexperienced pilot as well as the fledged commander.

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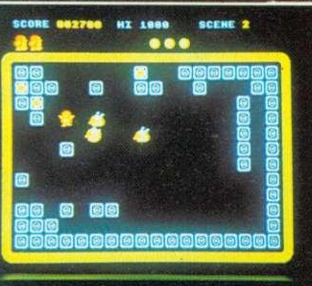
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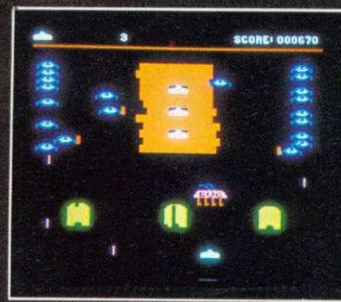
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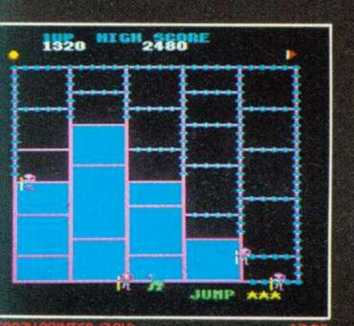
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(KEYBOARD or JOYSTICKS).
"...an extremely good version of the arcade game...thoroughly recommended."
...BEEBUG MAGAZINE



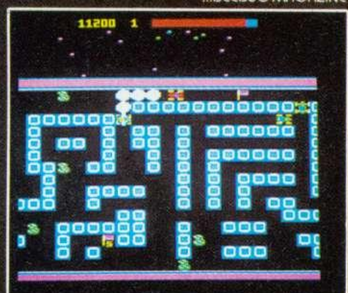
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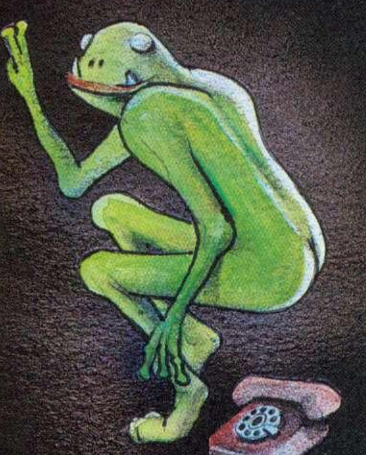


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●●●NEW RELEASE●●●



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BLOW YOUR OWN

Bruce Smith takes out an option on Softlife's EPROM programmer

Softlife EPROM programmer, Softlife, 87 Silvertown Way, London E16 4AH, BBC, £76.90 (inc VAT and p&p)

ON REMOVING the review model from its packaging my first thought was 'well, where's the rest of it?' A quick forage uncovered only the manual and an illustration proving that the item held in my hand was indeed the lot!

The programmer takes the form of a white plastic box measuring just 110 × 65 × 30mm, a bit bigger than a music cassette box. Protruding through the top is the all-important ZIF (Zero Insertion Force) socket into which the EPROM to be programmed (blown) is placed. A single length of ribbon cable passing through the side of the box is the only connection between computer and programmer.

As the Softlife programmer has been designed specifically for use with the Beeb it can accommodate both 8k 2764 and 16k 27128 EPROMs.

Connecting the programmer seemed simple enough, a matter of plugging the ribbon cable into the user port. However, my first efforts at blowing an EPROM proved fruitless and it was only after some head-scratching and then re-reading the connection instructions in the manual carefully that my mistake was revealed. The usual convention for cable connections is that the red coloured side of the ribbon cable is identified as the side adjacent to the triangle silk-screened onto the underside facia. In this instance, though, the reverse was true. It would have been better if the conventional method had been adhered to. Luckily no harm was done.

The software to run the programmer is supplied on an EPROM, which is loaded into memory by running a short five-line Basic program. Once there it can be saved to disc or tape if so required. Running the program displayed a menu of options as follows:

P(rogram EPROM from a file)
W(rite EPROM to file)
V(erify EPROM against a file)
T(est EPROM is blank)
C(hecksum EPROM)
S(elect EPROM type)
R(OM format)
M(OS call)

Before an EPROM can be programmed its contents have to be saved onto disc or tape. Pressing P sets the ball rolling and you are invited to enter the filename of the file to be placed in the EPROM, which is then loaded in. You are requested to insert an EPROM, which is first tested to ensure it is blank. If it is, programming commences.

Blowing an 8k device takes five minutes and a running count of the time left is given. On completion the EPROM is verified and a checksum value reported for future reference. A 16k chip was



programmed in a similar manner without problems, although I found I had to set Page to a more normal disc level of &1900 from its usual value of &1B00 on my system, to enable the software to load and verify the file correctly without an 'out of room' error occurring. The software also allows you to program, say, a 9k file into a couple of 8k EPROMs.

When you've blown the first EPROM you are prompted to insert the second for programming.

The more technically minded might wonder where the programmer sources the 21 volts required to do the programming. This is drawn from the 5v lines of the user port using an oscillator. Internally the programmer consists of a double-sided printed circuit board containing only a handful of components. Much of the hard work is actually performed by the user port's 6522 VIA chip.

I found the ROM format option the most intriguing. This allows the user to blow programs into EPROM using the ROM filing system format. Once present in a sideways ROM socket, the program(s) can be loaded simply by entering

```
*ROM
LOAD "Filename"
```

Any number of files in this format may be blown into a single EPROM, the only restriction being that imposed by the memory available in the EPROM itself.

On selecting this option the user is prompted for file names. These are loaded in turn and the appropriate headers added by the software. The EPROM is then programmed.

The ROM format facility offers a cheap alternative to discs, although the amount of memory available for program storage is reduced drastically, and of course you need an EPROM eraser to delete programs from the EPROMs.

The remaining menu options are self-explanatory. The W(rite) option saves the contents of an EPROM in the programmer to tape or disc while V(erify) compares the contents of an EPROM with that of a named file.

T(est EPROM is blank) allows you to ensure that the EPROM you've chosen is empty, but on closer inspection the option is shown to cheat. It checks only the first location in the chip. If this is equal to &FF it assumes the EPROM is empty. This would normally be the case, as a Basic program will always start with &0D (RETURN) and &FF is not a valid opcode in machine code.

Finally, S(elect EPROM type) permits you to choose between 8k and 16k EPROMs, and C(hecksum EPROM) displays the cyclic redundancy checksum of the chip currently situated in the programmer's ZIF socket.

The Softlife EPROM programmer performed exceptionally well. I have now programmed about a dozen EPROMs with it and every one has worked first time. At £76.90 including VAT and p&p it is certainly the cheapest EPROM programmer I've encountered. Its simplicity and compactness make it a highly desirable package for those interested in developing sideways ROM software, and its ROM formatting capability will give it wide appeal. Yes, I'd buy one.

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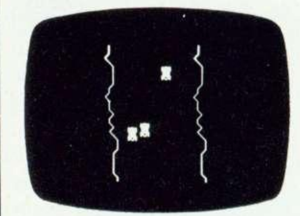
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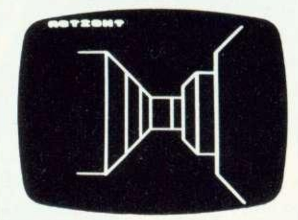
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SPACE CITY

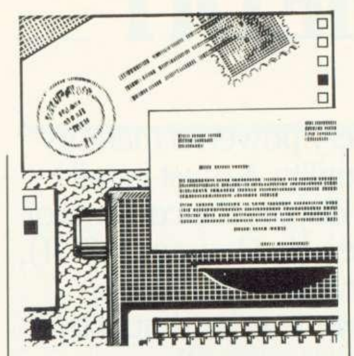

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Service for the legitimate user

Sir, With reference to the letter from Mr Pretorious (April issue, page 169) I would like to present the case from a supplier's point of view. In our case we have experience of both sides of the fence.

The best-selling program in Clares Micro Supplies' catalogue is *Replica II*, which allows the transfer of cassette-based software onto disc. This could obviously have posed great problems due to piracy but from the start we were concerned with protecting other software houses while still providing a good service to the legitimate user. To this end it was decided that the transferred programs would be stored on the program disc and this disc would be protected to prevent copying. This ensures that copies of the transferred programs cannot be passed around. The programs on the disc are useless without the *Replica* programs and these cannot be copied. We have talked to software houses that have been happy with the situation because they have no intention of supplying disc-based software and this is one way of keeping their customers happy. In fact, we now have a scheme that will allow software houses to recover some of the lost revenue on pirated copies of their programs. If any companies are interested in this idea they should contact me on 0606 48511.

Now to the question of corrupted tapes and discs. I think you are being unfair in stating that there are no software houses that provide a prompt exchange of corrupted discs or tapes at a minimal charge. My experience as a purchaser is that most reputable companies will do just that. However, do not expect refunds because it is commercially unsound to let a user have the use of a tape, which he may or may not copy, and then to give a refund. It would be like providing a hire service for the cost of a stamp. Before printing such derogatory statements why not conduct a telephone survey to find out the real situation instead of making guesses. I am sure that one of your very efficient telephonists could provide a quite accurate picture within an hour. Surely, being correct is the essence of good journalism even if it is not as sensational.

Our own company will provide exchanges of corrupted software, often without charge. Even when the fault lies elsewhere we are always prepared to assist for a minimal charge. *Replica II* is a good example because, due to the fact that programs are stored on the disc, it can become corrupted by various external means. Things such as bugs in DFS chips, incorrect usage or unscrupulous companies that insert routines in their cassette programs which will destroy a disc if the disc filing system is active. The legality of this last action is questionable. While none of the above would have any effect if users followed our instructions correctly we do not abandom them. We will always recopy a disc for a charge of just £1 to cover copying and postage. Even if a user destroys a disc by spilling a cup of coffee on it we will charge only for a replacement blank disc. The same applies to all our disc software, although corruption is very rare in these cases.

I would also point out that responsible companies do provide corrected versions of software found to contain a significant bug and this is a service that we provided recently with our database program, although this was an enhancement and not a bug. Another company with an exemplary record in this area is Pace, which has always provided free upgrades of its DFS. You will notice that I used the term 'upgrade' as this is very different from correcting a bug. An upgrade is an enhancement for which there may be a charge.

The other question that is always raised is that of upgrading from cassette to disc. People who have no idea of how the business operates find it difficult to understand the problems associated with such a service. First, many disc versions of programs are actually enhanced versions of the cassette-based one and as such are essentially different programs. The programs returned for upgrade would present a logistical problem because of the sheer volume. Royalties have to be paid on programs, but how does one calculate the royalty payable on what is probably a loss-making service? As most companies supply by mail and through distributors and dealers it would be impossible to decide which price structure applied to which program. Because of the various discount levels given to distributors and retailers the software house could be faced with a situation where it has made a very small margin on bulk sales and is then expected to upgrade that program to disc with the nett result being a loss. Who will you buy your software off when we are all out of business?

Yet another problem is caused by the useless tapes. They cannot be re-used and they have to be irrevocably destroyed, which again costs money. To incinerate a box of cassettes costs £50 in rural areas and probably more in cities.

If we can get together with software houses there will be no need for such a service because *Replica II* can provide the answer at a reasonable cost to the user and also provide a return to the software house.

D Clare
Clares Micro Supplies
Northwich, Cheshire

Do we need to phone around to get a clear picture when we have had hundreds of complaints from readers? Why, if everything is so rosy, don't software houses even mention in their advertisements the back-up services they give? Do dealers give the same service?

Surely the provision of 'enhancements' has been used to prevent people getting free copies of debugged software. Why doesn't anybody offer a straight debugged version to send free to people who would be happy with that?

Piracy . . . sideways

Sir, With the daily increase in the sophistication of computer technology, it is inevitable that whatever is produced by one manufacturer will ultimately aid the piracy of another manufacturer's product. This 'legal piracy' can be highlighted in many ways, but perhaps the most recent is the introduction of sideways RAM.

The acclaim for its versatility is well founded. Its ability to allow extra program workspace, as well as hold several disc-based ROMs at a time, gives it a definite advantage over sideways ROM boards, which are prone to such niggling problems as overheating and excessive power drain. However, it must be seen by ROM manufacturers as a threat, particularly as one version comes complete with a ROM copying cartridge to enable the user to transfer his ROMs to disc. What then happens to the redundant ROMs? Most likely they are sold, at a reduced price of course, and the ROM manufacturer has lost yet another sale. The manual? – ever heard of photocopying?

With the availability of many ROM-to-disc copying utilities, the sideways RAM owner can copy any ROM he can lay his hands on, be it from a friend, neighbour or fellow club member. He doesn't even need to remove the ROM from its parent computer, or for that matter, buy or borrow an EPROM programmer. He is totally unaffected by the inflated EPROM prices and doesn't have the capital outlay of a sideways ROM board and up to 16 ROMs at £30+ each. This letter is not aimed at encouraging piracy by promoting sideways RAM, but its advantages cannot be ignored.

Perhaps the only answer is a 'self-destruct' ROM that erases itself when copying is attempted. The loss of a £30+ ROM would coincide with the loss of a friend and a corresponding reduction in piracy. With the advent of EEPROMs (electrically eraseable PROMs), produced already by at least 11 firms, this is now quite feasible, particularly as one manufacturer derives the erasing voltage from an 'on chip voltage generator' operating from the normal 5v supply. This precludes the possibility of interrupting the erasing voltage.

While this is not the only answer, it must be worthy of further investigation – so come on all you ROM manufacturers, the ball's in your court. What's your next move to combat this 'legal piracy'?

G A Dubber
Hants

Several suppliers of software in ROM or EPROM form have already looked into chip protection. Available techniques are too expensive, but Gemini, for instance, has made things difficult by using two EPROMs mounted on a board, with other simple chips.

ASK a silly question, pass a fair comment, stage an angry protest – we don't mind what you write to us about (or about us!). Keep 'em short, keep 'em sweet, but keep 'em coming! The address is: Letters, Acorn User, Redwood Publishing, 68 Long Acre, London WC2E 9JH.

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Greetings from Watford

Grave message

Sir, I recently started taking your magazine and have followed with interest the exchanges of letters to, from and about Watford Electronics.

Today I was playing with my latest toy and found that Watford's ROM contained considerably more than a screen dump routine. The attached printout (above) is self-explanatory.

You will not find it surprising, I am sure, that I resent paying £19.09 to have a message like this installed in my purchase when I am, like most, a bona fide, paying, customer.

R M Pothecary
Surrey

Pirates' club

The following letter was forwarded by Microdeal, whose correspondent, writing from Eire, gave his full name and address but asked to remain anonymous.

Sir, Until recently I had no feelings either way towards software piracy, but copying a tape for a friend did not seem too bad considering that the average cost of a Dragon game was about £8. However, I am now appalled at mass software piracy and this is why I am writing to you.

A Dragon 32 users group has recently been set up in Belfast. It charges no entrance fee and does not call itself a club. But, you ask, if it doesn't charge an entrance fee, how can it cover its cost and turn a profit? The answer is simple: software piracy.

The group is open to anyone and is a mail order type one. Each member receives a list of available software and their prices. Software comes from your company [ie, Microdeal], Salamander, Dragon, DACC and others. The last list that I saw showed that all your software was available. Your £8 programs were available for £1 and Tele-Writer was available for £10.

The duplictating was a very professional job as far as I could see. Tape was spliced to the correct length and all the tape cassettes were of the same make. The instructions were either hand-written or computer printed. In the case of DACC's *Flight Simulator,* which has long and complicated instructions, they were photocopied.

I sincerely hope you will stop this operation and inform the other companies involved. I got the information from the documents sent to members (a friend of mine is one) and, believe it or not, from a computer magazine. I don't know the UK's copyright laws very well but I assume they are sufficient to frighten such groups into closing.

Bugbeaters

Sir, I feel drawn to comment on Rod Borland's letter (February issue). I exist only to serve his second type of user – those who use a microcomputer as a reliable tool. I debug programs which refuse to work, and help users plan their own. I also deal with magazine or book listings, which have a high rate of inaccuracy, and which can cause confusion with the use of graphic characters, as on the Spectrum.

I have advised on package facilities because documentation has been inadequate, and even solved a problem by suggesting that the Record button needs pressing on a tape recorder when saving a program!

So if any of your readers are in a similar position to Mr Borland, please try me first. Incidentally, we must be on the same wavelength, as I have called my advice service the very word you used in describing Mr Borland's letter – Bugbear!

Frances Daniel
42 Brookside Avenue,
Kenilworth, Warks

Northern lights

Sir, We would like to inform you of the existence of our Swedish BBC users group, BUG. The group was formed in October 1983 and we publish a monthly newsletter. Another service for the members is our own database devoted entirely to the BBC, although it is possible to make connection with other computers.

The transmission speed is 300 baud.

We very much want British BBC users with modems to call us. The telephone number is (0) 8-46 35 28.

With the database it is possible to send electronic mail, down/upload software, play games and lots more.

Anders Wickman
Folkungagatan 58
116 22 Stockholm

Help the aged

Sir, I am an occupational therapist currently working with elderly patients. We have recently acquired a BBC B micro, but we are faced with the problem of finding 'suitable' software for these patients. We need programs that are:

- Appropriate to the elderly age group (no childish graphics, nursery rhymes, etc)
- Educational
- Large print
- Not too much information on the screen at one time
- Colourful
- Not requiring the use of too many keys on the keyboard
- Any using Concept keyboard if possible

Should anyone reading this be able to help us with programs, information, advice, contacts, etc, we would be most grateful.

Karin Treial
Hackney Hospital
Homerton High Street
London, E9
Tel: 01-985 5555, Ext 46 or 14

Testing VDUs in the field

Sir, With reference to George Hill's monitor reviews in the April *Acorn User,* I found the programs useful as I was about to buy a monitor. I joined the two programs together with an A$=GET$ line between them so that one would run after the other, and took a copy with me to a show.

There are three levels of slot pitch of a tube, a colour TV being the basic. The SP of each monitor is marked, as manufacturers do not use a common basis.

I tried the program out on every monitor I could, including the two models of JVC (medium and high resolution) on the Opus stand, both the medium and high resolution Hantarex monitors, the low, medium and high resolution Microvitec monitors, and a Philips monitor/TV. (I used ten different Microvitec sets.)

Using the stripes program, I found the resolution and clarity of the Hantarex medium was OK, and the high excellent, but both were spoilt by very poor alignment, the picture was out of square, went off the screen at both the top and bottom, the sides of the picture were slightly curved and the colour guns were set wrong, giving colour fringes to everything. The JVC medium was poor, the JVC high-resolution set was about the same as the Hantarex medium, but the colour guns were again set wrong, though not as bad as the Hantarex, and the picture curved very badly on all four sides. The Microvitec low was the same as most TV/monitors, the medium and high resolutions were both excellent in every way, with the right amount of gap at the top, bottom and sides of the screen, straight on all sides, no colour fringing, and a good white. The Philips monitor/TV was found to be better than both the Microvitec low resolution, and the JVC medium resolution. These opinions were shared by others who watched the tests.

I was all set after reading the test by Mr Hill to buy a JVC high resolution monitor but after the tests I conducted, of which the stripe program was an important one, I purchased a Microvitec Cub medium resolution model 1451/MS4, which has the advantage of a screen which absorbs some light rather than reflect it all. I have used this monitor for periods of up to ten hours and found all eyestrain has gone and I feel much fresher when I have finished.

I would suggest to Mr Hill that

before concluding a test he checks the specification of the sets and compare like with like, as from what I can find out most school monitors are the low-resolution type.

R C Luxton
Gwent

A valid point, and thanks for your comments. We hope the detail in this issue's monitor reviews (page 134) is more to your liking. We're glad to see readers going out and using the programs like this – it's exactly what we print them for.

Adjustable Electrohome

Sir, In George Hill's review of monitors he claimed that his high-resolution Electrohome was not adjustable except for brightness. My medium-resolution version of this monitor has several adjustments which can be made with a small screwdriver through a grid at the rear, as instructed by the manufacturers. One of these is a vertical height adjustment. By slightly compressing the screen on the monitor, losing only about 0.5cm at the bottom, the top line on my Electron becomes completely visible.

Since the Electron does not respond to the Beeb's *TV255,1 this may be a great boon to Electron owners. Possibly other monitors have the same facility?

R Harper
Dunstable, Beds

Mystery of PL4

Sir, I wonder if you could explain what purpose PL4 serves on the Atom. I presume it will provide sufficient information to drive a colour monitor, but I have never been able to have this confirmed. If this is not so, who now provides colour encoder cards for UHF output? I am having difficulty finding stockists.

Nigel Harper
North Humberside

Barry Pickles writes: PL4 provides the necessary signals (from the 6847 VDG) to interface to an NTSC modulator. To use this on British TVs/monitors additional circuitry is required. *Acorn User* (October 82) described the construction of an RGB monitor interface but a colour encoder is needed if you wish to use a TV set. As you say, these are hard to come by, but I can recommend the one from Ampersand Computers – this will be reviewed shortly. It is supplied in various forms, but you may buy a ready-built one for £21.50. Ampersand's address is: 86 Neal Road, West Kingsdown, Sevenoaks TN15 6DQ.

Disc standard

Sir, The majority of advertisements in *Acorn User* for disc drives refer to the 5¼in size, the 3in models being only recently introduced and as yet not as popular. Drives of 8in size do not appear to be available on the personal computer market and seem to be utilised mainly by industrial users.

The magazine *Electronic Engineering* of October 1983 referred to the setting up of the Microfloppy Industry Committee in May 1982 with the objective of uniting manufacturers to a single standard system. The system being supported is a 3½in microfloppy, the Shugart SA300 being such a model referred to.

With so many manufacturers marketing so many sizes could you confirm whether any standard is being introduced for disc drives? I am contemplating purchasing a drive for the BBC computer, and do not wish to purchase a system that may be obsolete in a few years' time.

G Cooke
Merseyside

The committee you refer to was set up in the US, with just four members, and little has been heard since. The standard was suggested by Shugart itself.

The electronics and computing fields are renowned for trying to produce – or even actually passing – standards.

Video is the most obvious example, but interfacing is a classic in computing with Centronics, RS423, RS232C, IEEE all enjoying the 'standard' label. The problem is that everyone goes off and 'interprets' the standard in different ways, or implements just part of it. Then you get some of the big companies producing their own interfaces to make it difficult for others to produce 'compatibles'.

There seems little chance of any microfloppy standard because, just like the video industry, the industry is split – and companies such as Sony and Hitachi aren't going to settle on Shugart's system.

Even if a standard is set, only in industries where international protocols really matter – such as communications – will it be kept.

One old hand in computing was once asked which would become the standard, 3in or 3½in. His answer was: 'Oh, definitely 3in. Why was he so sure? 'Because it fits in my shirt pocket'.

Dating game

Sir, What a clever innovation by your new publishers! The idea of leaving blank pages (April issue, pages 107-108) for readers to insert their own programs is an excellent one!

Enclosed is my own *Date of Easter* program which uses a neat algorithm due to T H O'Beirne.

G J Suggett
Chichester

```
10MODE7
20PRINTTAB(11,3);CHR$(141);"DATE OF
EASTER"
30PRINTTAB(11,4);CHR$(141);"DATE OF
EASTER"
40 PRINT'"Using an algorithm due to
T. H. O'Beirne - see 'Puzzles and Parad
oxes', Oxford University Press, 1965, c
hapter 10, pp168-184, 'Ten divisions le
ad to Easter.'"
50PRINT'"Year (Gregorian calender)?"
60INPUT X%
70PRINT '"Date of Easter Sunday is:"
110A%=X% MOD 19
120B%=X% DIV 100:C%=X% MOD 100
130D%=B% DIV 4:E%=B% MOD 4
140 G%=(8*B%+13) DIV 25
150H%=(19*A%+B%-D%-G%+15) MOD 30
160M%=(A%+11*H%) DIV 319
170I%=C% DIV 4:K%=C% MOD 4
180L%=(2*E%+2*I%-K%-H%+M%+32) MOD 7
190N%=(H%-M%+L%+90) DIV 25
200P%=(H%-M%+L%+N%+19) MOD 32
210IF N%=3 THEN PRINT 'TAB(5);"March
"; ELSE PRINT TAB(5);"April ";
220PRINT P%
230PRINT''''"Another year?"
240IF GET$="Y" THEN RUN
250END
```

G J Suggett's alternative to Paul Caswell's date-finder, published last month.

Smoother ADC

Sir, I would like to compliment Paul Beverley on his excellent article about the BBC's analogue-to-digital converter chip (March issue). We are using a BBC micro as a 'data station' between scientific instruments and an intelligent plotter and were always a little disappointed at the 'shakiness' of the plotter printout. Needless to say, Paul Beverley's article held the answer.

However, perhaps because we have the Watford DFS we were unable to load Paul Beverley's program at his start address &C00. In any case, we have user defined characters in our programs which would have been overwritten by the averaging routine. I realise it is of no consolation to cassette users, but we are able to load this routine at &900, changing line 20 of the averaging routine program accordingly. Our plots on the screen and on the plotter are now a lot smoother – thank you.

Dr Alex F Drake
King's College, London

Raid cheat

Sir, with reference to high scores. The highest scores achieved at my school to date are:

Snapper – 116,320
Snapper (joystick) – 143,420
Dare Devil Dennis – 6520
Meteors – 21,250
Monsters – 38,680
Zalaga – 132,260
Rocket Raid – 700,000 +
Arcadians – 28,760
Defender – 356,775
Planetoid – 236,100
Starship Command – 1376
Moon Raiders – 285,580
Killer Gorilla – 496,200

One interesting score is the *Rocket Raid* one – this is achieved by 'cheating' thus:

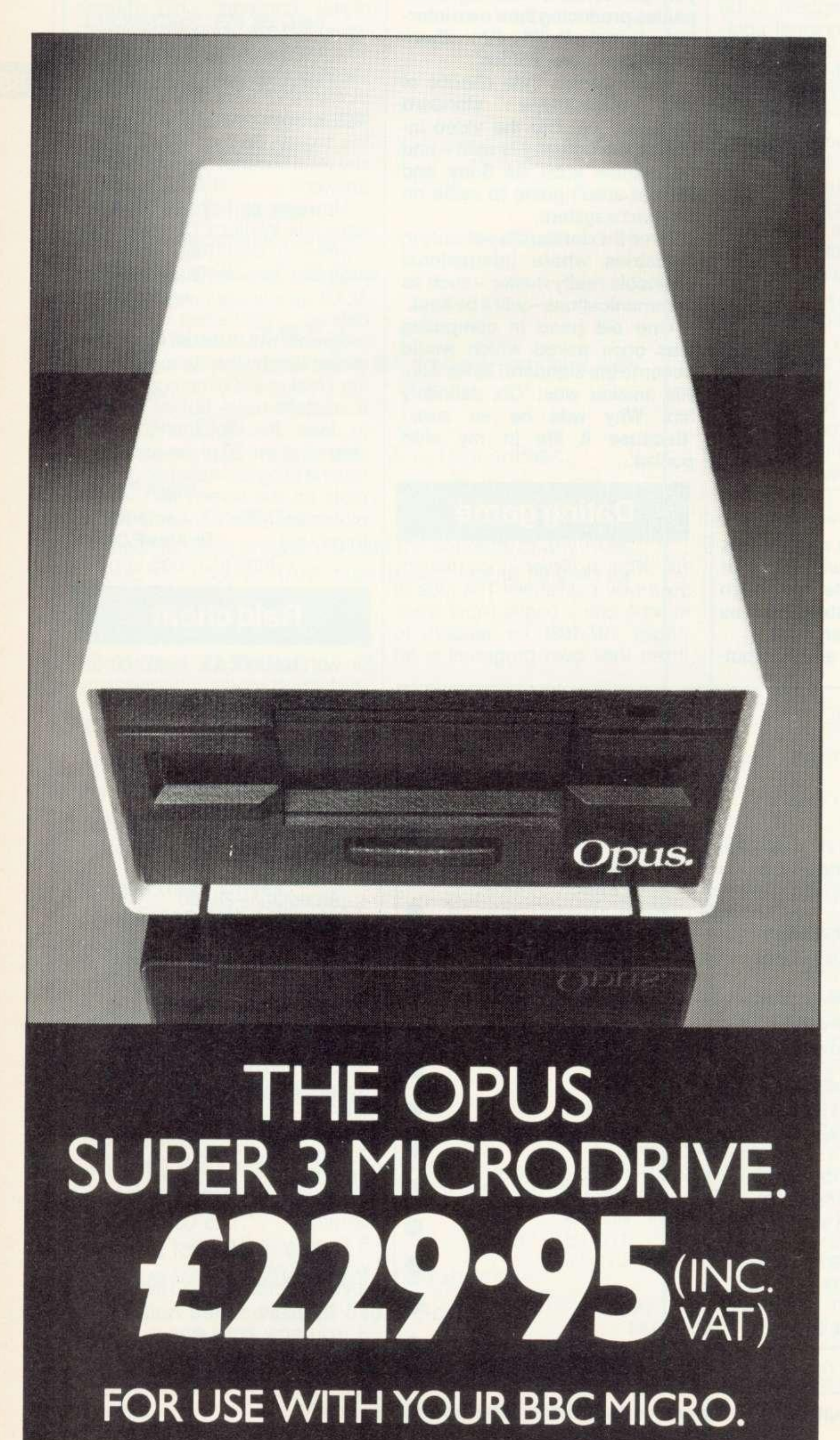
1. PAGE = &E00:*TAPE
2. CHAIN"" (load *Rocket Raid*)
3. When the game has loaded press BREAK
4. Type CALL&E00 and press Return
5. Destroy all 3 ships – the screen will go haywire
6. Wait approximately 3 minutes
7. Play game
8. You now have about 70 men before step 6 repeats.

N.B. The score is reset on pressing ESCAPE.

B Nesbit
Northants

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	TOTAL	

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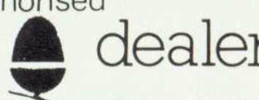
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COMPUTER CONCEPTS

ROM SOFTWARE

for the BBC Micro

Disc Doctor

```
DISC DOCTOR 1.09
DIS (<sta>) (<end>) (<ofs>)
DISCTAPE <afsp> (<afsp>) ...
DOWNLOAD <fsp> (<adr>)
DSEARCH <str> <trk> (<trk> <sct> <drv>)
DZAP (<trk>) (<trk> <sct> <drv>)
EDIT (<key no.>)
FIND <str>
FORM <drv> <no. trks> (<stt>) (<S>)
JOIN <fsp> <afsp> (<afsp>) ...
MENU (<drv>)
MOVE (<dest page>) (<src page>)
MSEARCH <str> (<adr>)
MZAP (<adr>)
PARTLOAD <fsp> <ofs>   ext> <adr>
RECOVER <trk><sct> <sct> <adr>  <drv>
RESTORE <trk> <sct> <sct> <adr> <drv>
SHIFT <src> <dest> <ext>
SWAP (<drv>)
TAPEDISC (<fsp>) ...
VERIFY (<drv>) (<no. trks>) (<stt>)
```

DISC DOCTOR is a general purpose utility ROM which adds 20 new commands to the BBC Micro. Most of these are concerned with disc operation although some of the commands are general purpose.

The extensive range of disc commands include a disc search routine and a very easy to use sector editor which allows any sector to be examined and changed if necessary. The built-in formatting command has a special option allowing dual catalogues on each side of the disc, so that up to 60 files per side may be used - almost twice the normal limit.

⋆RECOVER and ⋆RESTORE commands are provided to help in the restoration of deleted or partially corrupted files. Any area of the disc may be transferred to memory, altered and ⋆SAVEd or ⋆RESTOREd back onto the disc. These commands prove invaluable when hours or even days of work are accidentally lost.

Many disc users often encounter the frustration of programs originally designed for use on cassette and require relocating to operate on disc. Disc Doctor provides commands to help with the transfer. ⋆TAPEDISC and ⋆DISCTAPE provide a simple means for automatically transferring non-protected files between tape and disc. Once programs are on disc, there are several relocation functions available. ⋆MOVE will move a program from one page in memory to any other. ⋆DOWNLOAD will load the program from disc and automatically move it to a specified position. ⋆MENU is more comprehensive still, offering a menu of programs available and allowing single key-press selection of any one. The chosen program is then loaded, re-located if necessary and automatically executed, whether BASIC or machine code.

General purpose commands include: ⋆DIS - which will disassemble an area of memory, following or skipping jumps, adding an offset, disassembling an instruction at a time or disassembling continuously.
⋆MSEARCH - to quickly locate any string of bytes in memory, specified either as a character string, numeric values of a mixture of both.
⋆MZAP - a very easy to use memory editor, allowing the user to scroll quickly up/down memory. It can be called from other programs to examine memory, then return to the program.
⋆EDIT - will list any or all of the function key definitions, so that the user may edit and copy them.

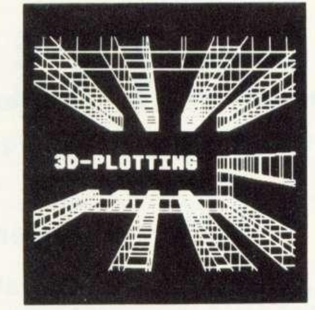
The DISC DOCTOR ROM contains a full help menu listing all the commands and their syntax for quick reference. A spiral-bound manual gives general information about discs and describes each of the commands in detail, with examples. Easy-to-follow fitting instructions are supplied, allowing the ROM to be easily fitted by even the inexperienced user.

Easy to Fit

Disc Doc

£33.35 incl.

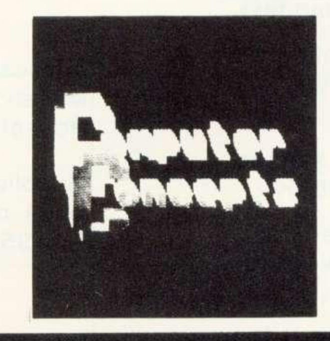




The GRAPHICS EXTENSION ROM brings 30 new powerful graphics commands to the BBC machine. The commands may be typed immediately or included within programs written in BASIC, BCPL, FORTH, etc. The commands act quickly (being machine code) and are always available without taking large amounts of program memory. The commands can be split into three catagories:

1. Sprite Graphics
A sprite is similar to a user-defined character, except that sprites may be multi-coloured, several times larger (8x8 to 24x24 pixels in size), they are easily defined and altered with in-built commands and may be saved and later loaded. Sprites may be displayed and quickly moved around. Up to 32 different sprites may exist at the same time. 'Films' may also be created, in which any sprite is treated as a single 'frame'. Each time the 'film' is used the next 'frame' in sequence is automatically displayed, allowing simple animation of sprites. Any number of the possible 32 sprite numbers can be defined instead as a 'film' which may include a list of up to 47 'frames' in any order.

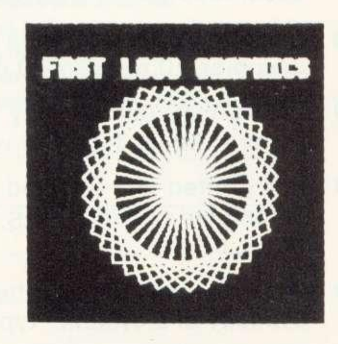
2. LOGO 'Turtle' Graphics
By using simple FORWARD, BACKWARD, LEFT and RIGHT commands a 'turtle' can be moved very quickly around the screen, producing intricate patterns by the most user-friendly means. The commands may be included in structured BBC BASIC programs providing a system faster and more powerful than many of the packages currently used to demonstrate LOGO turtle graphics.



3. General purpose commands
⋆ FILL will fill an intricate shape.
⋆ CIRCLE provides fast and easy circle drawing.
⋆ ARC fast easy arc drawing.
⋆ PLOT provides 3D graphics drawing by plotting with X, Y, and Z co-ordinates.
⋆ SCALE allows a scaling factor to be applied to everything subsequently plotted.
⋆ ROTATE applies a rotation upon all subsequent standard PLOT, DRAW and MOVE commands so that they are rotated around any origin.

A built-in help menu showing the syntax of all commands is provided for quick reference. Included in the package is a comprehensive spiral-bound manual and step-by-step fitting instructions, suitable even for the inexperienced.

Further details available upon request.



£33.35 incl.







16 Wayside, Chipperfield, Hertfordshire. WD4 9JJ Telephone: Kings Langley (09277) 69727

ATOM programs for sale: Life package, Starburst, Adventure 1, Atom-Man (Hopesoft), Atomstore, Invaders (Aardvark), maybe more. All £4 except for invaders – £3. Ring Andrew (0474) 812704 (Meopham), evenings and weekends.

BBC B 1.2 OS + cassette recorder, joysticks, monitor stand, magazines including Beebug subscription, piles of software, bargain £375 ono. Contact C.B. Morgan, The Lodge, Qeqm, Furze Lane, Southsea, Portsmouth, PO4 8LW.

***HELP.** Information or manual wanted on General Electric Terminet 30 type ITT 3330 dot matrix printer. Nick Ellis, 'Open View', New Road Hill, Midgham, Reading, Berks. Tel 712428.

CENTRONICS 739 printer with lead for Atom £160; Atom colour board (unused) £15; Acorn PROM programmer (EPROM and bipolar) £50; offers considered. Faulkner, Tel: 01-387 9621 ext 68, or 01-549 1559.

DISC drives. Microware ZL242 dual, double sided 40 track (400k). Cased with own power supply and long cable, £295. Tel 01-445 3000.

COLOSSAL Cave adventure from Level 9. This is a top quality adventure game with enormous text. Very fast – kept me busy for months. Complete with original instructions. £6. Kidlington (08675) 78776 (near Oxford).

22" colour monitor RGB for BBC computer. In excellent order, little used, is large, heavy and not easily portable, but suit school or similar. Only £120. Phone Haverhill 702311.

BBC model B with disc interface just 6 weeks old, unwanted gift, £375. Tel 01-953 0527.

60 magazine back issues for sale. 16 PCW, 11 Your Computer, 9 Micro User + Popular Computing Weekly, C+VG, etc. £15 ono. Phone 021-554 1869. Buyer collects from Birmingham.

DISC drives. Microware slimline dual d/s 100k £350. View ROM with manuals and drivers, cost £70, accept £50. Killer, Croaker, Swoop, Filer, Polaris, Martians, Geography £5 each, Early Learning £7. 01-660 8360.

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ATOM, FPROM, Werom utility, VIA, buffers, 12k RAM, 5v regulated supply, books and manuals. Sell for £80. Phone 051-546 9599 after 6pm.

SOFTWARE for sale. Acornsoft's Planetoid, Snapper, Rocket Raid, Meteors, Monsters. Also Computer Concepts' Chess and Clares' Replica disk. All originals, boxed and with documentation. £5 each. Phone Peter 01-958 8021 (Edgware, Middx.).

BBC general knowledge quiz, mode 7, colour, model A or B. Over 100 questions. £2.50. W.F. Kitching, 1 Greenacres, Ketley Bank, Telford, Salop TF2 0DU. Phone 0952 613824.

ACORN AP100A printer (Seikosha GP100A). Interface cable. Dust cover. Paper. Excellent condition, £150. Exeter 68065.

SWAP Electron software. Phone Harpenden (05827) 5232 after 5pm. Ask for Ian.

WANTED. BBC Teletext Adaptor in exchange for Atari VCS and twenty cartridges. (Everything in perfect working order.) Tel: 041-946 9110 any time after 6pm. 14" colour monitor also considered.

BCPL ROM disc manual £50. Acornsoft Forth cassette £8, Desk Diary, Magic Garden, Philosophers' Quest £5. Wordwise ROM £18. BBC Vu-Type typing tutor £8. Snow-Ball adventure £5. In original packaging. 01-900 0884.

BBC B computer with loads of games (most Acornsoft games and many others). 1.2 OS, 14 months old, with books, leads, languages and disassembler £360 ono. Ring Bristol (0272) 739803 between 5 & 6pm.

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SWAP many titles including Zalaga, Cylon Attack, Twin Kingdom Valley, Killer Gorilla, Planes, Frogger, Painter, Moonraider, Felix, Snapper, Monsters and many more. Disc or Tape. Phone 05255 2056, Dave, evenings.

GREEN screen monitor, 12" Sanyo for sale. Excellent condition £60. Monte, Runcorn 69506 (evenings), Runcorn 711330 (office hours).

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MCP40 printer/plotter as new only three months old £90 ono. Phone 08444 3301 (evenings) and ask for Alan.

WANTED: old 1.0 operating system supplied as 2 EPROMs on c/board, will pay £5.50. Phone 01-202 6410 (Mr. Vekaria) after 7pm.

SEIKOSHA GP100A 15 months old, complete. New ribbon, screen dump for BBC original manual and packing. £165. Tel Romford (0708) 44718.

FLOPPY discs, 8", soft sector, unused – 1 box of 10, 1 box of 13; £15 per box or offers. Audio tapes, 1 box of 10, 3" reel, unused; £5 ono. Tel: Aldershot 316649.

WANTED Quickshot II joystick in good condition. Pay good price. Phone Reigate 42162 or write to Alex Daly, 2 Brokes Road, Reigate, Surrey.

SOLAR Soft Zany Kong original 40 track disk £8, as new. Guy Davey, tel 0273 832555 after 5pm.

BYTE, Kilobaud, Microcomputing and other American magazines for sale. Sae list. Smith, 84 Edenfield Gardens, Worcester Park, Surrey, KT4 7DY.

COMPUTER Concepts ROMs: Termi, Disc Doctor £10 each. Beebcalc, Wordwise £15 each. Graphics ROM £15. Watford Beebfont £15. Printer monitor £10, Acornsoft View £25, BBC Buggy £95, Grafpad digitiser £80. (0344) 886178.

ATOM 14k + 12k, FP & Watford ROMs, VIA, heavy duty psu, amateur radio RTTY software and interface. All sorts of books, software etc. £125. Tel Kevin (G6JUI), Reading (0734) 507137 evenings.

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Acorn User will support any attempts to prevent individuals copying tapes and selling them through the pages of this magazine.
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WANTED. Good database management system program for disk-drives. Will exchange for good business software. Contact Mark, 01-805 7046, evenings only.

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WANTED for BBC – EPROM progrmr; printer; light pen; ROM board – will swap Sharp PC1500; Casio PB100; Minolta camera; Panasonic personal hi-fi; green monitor; airgun; several calculators (expensive ones). Ring Squid 01-624 7460.

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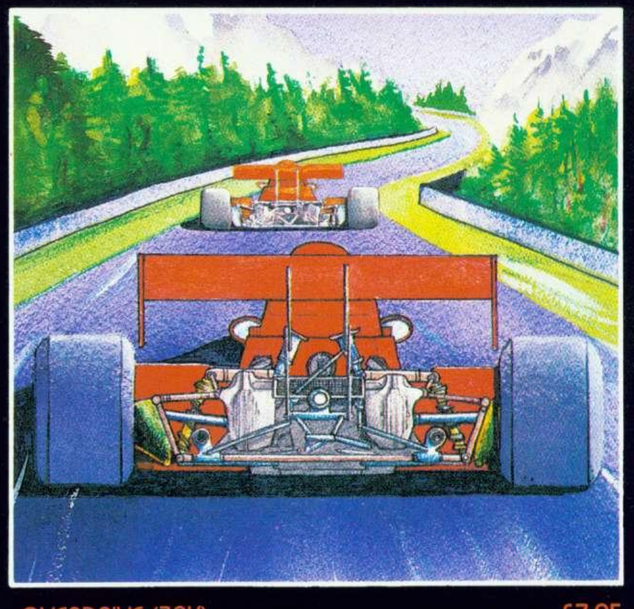










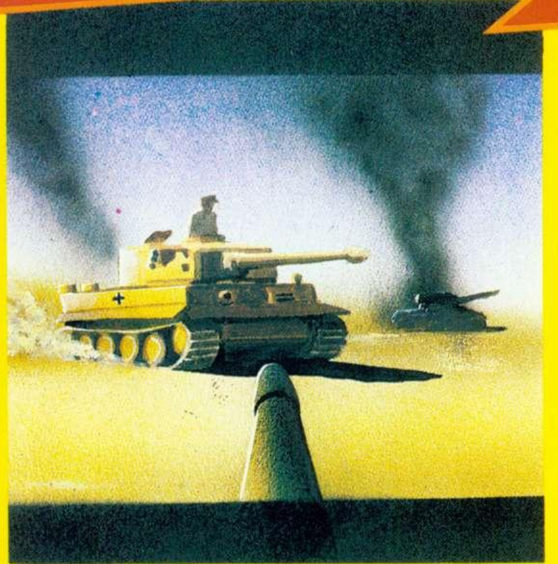


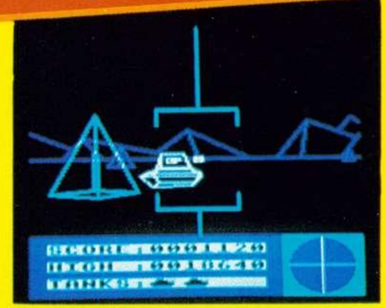
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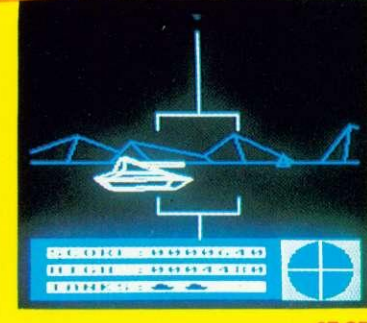
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